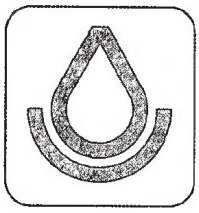
SOIL SURVEY OF

Green Lake County, Wisconsin



United States Department of Agriculture
Soil Conservation Service
In cooperation with
Research Division of the
College of Agricultural and Life Sciences
University of Wisconsin

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1970–73. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Research Division of the College of Agricultural and Life Sciences, University of Wisconsin. It is part of the technical assistance furnished to the Green Lake County Soil and Water Conservation District. The fieldwork that is the basis for this soil survey was partly financed by the Green Lake County Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Green Lake County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the woodland group, wildlife group, tree and shrub group, and recreation group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability groups.

Foresters and others can refer to the section "Woodland" where the soils of the county are grouped according to their suitability for trees.

Wildlife managers and others can find information about soils and wildlife habitat in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the sections "Land Use Interpretations" and "Recreation."

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about the soils in the section "Formation and Classification of Soils."

Newcomers in the area may be especially interested in the section "General Soil Map," where broad patterns of soils are described.

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SOIL SURVEY OF GREEN LAKE COUNTY, WISCONSIN

BY FRANK L. ANDERSON AND HOWARD F. GUNDLACH, SOIL CONSERVATION SERVICE

FIELDWORK BY FRANK L. ANDERSON, HOWARD F. GUNDLACH, KIM A. KIDNEY, AND MICHAEL J. MITCHELL, SOIL CONSERVATION SERVICE

OTHER CONTRIBUTORS ARE CARL L. GLOCKER, ROBERT A. PATZER, S. MICHAEL SHIVERS, AND BRUCE G. WATSON, SOIL SCIENTISTS

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE RESEARCH DIVISION OF THE COLLEGE OF AGRICULTURAL AND LIFE SCIENCES, UNIVERSITY OF WISCONSIN

GREEN LAKE COUNTY is located slightly southeast of the center of Wisconsin (fig. 1). It extends about 24 miles from north to south and 18 miles from east to west at its widest points. The total land area is about 354 square miles, or 226,816 acres. The county seat is the city of Green Lake, which is in the east-central part of the county. Green Lake County is named for the deepest lake in Wisconsin.

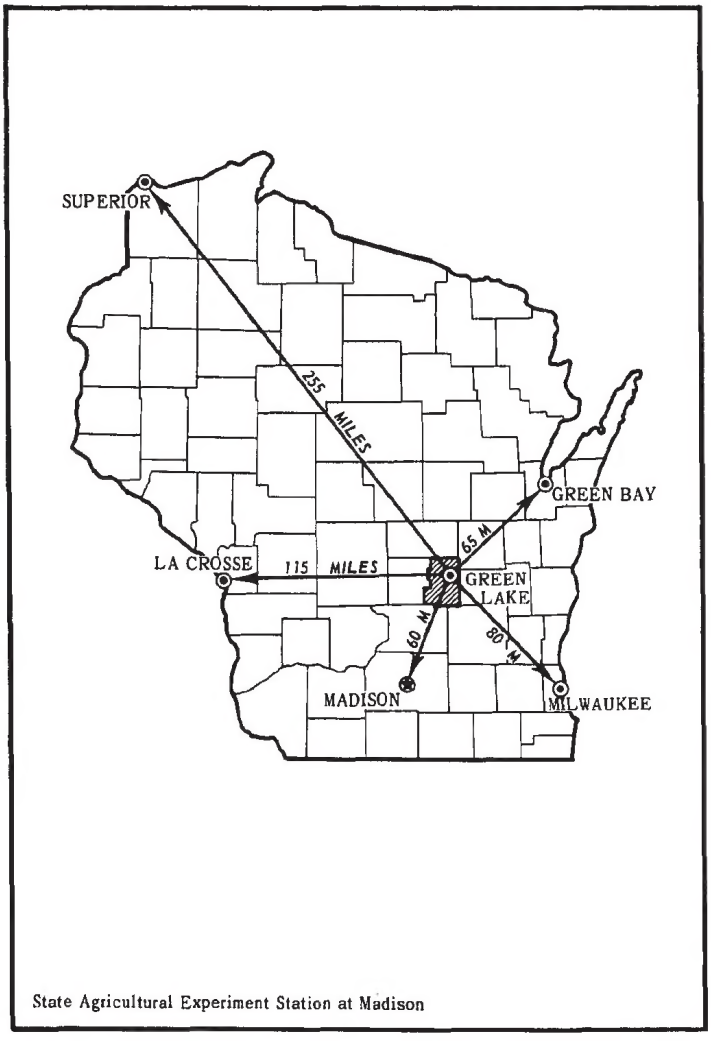

Figure 1.—**Location of Green Lake County in Wisconsin.**

In 1970, the population of the county was 16,878. Berlin, in the northeast corner of the county, is the largest city and has a population of 5,297.

Farming, manufacturing, and tourism are important in Green Lake County. In 1970, about 15 percent of the workers were employed in jobs related to agriculture, 7 percent in construction, 29 percent in manufacturing, 4 percent in transportation and utilities, and 45 percent in other services. In 1969, 74.7 percent of the county was in farms.

The number of farms is decreasing, and the average size of farms is increasing. An average farm income of $17,000 is ahead of the State average. Milk is the most important source of farm income. The county ranks among the highest quarter of Wisconsin counties in hog marketing and in the processing of sweet corn and green peas.

Originally the county was not extensively forested. Today about 12 percent of the land area is woodland. The woodlands are mostly small tracts scattered through the northern and western parts of the county. These tracts supply wood products needed on farms, and they provide some cash income from the sale of wood products.

Green Lake County has made relatively greater gains in manufacturing than the rest of the State from 1963 to 1967—in number of persons employed, in payroll, and in value added by manufacturing. There are 133 factory jobs in the county per thousand people, compared to the State average of 118 per thousand. Further industrial growth seems likely because of the favorable location of Green Lake County relative to the Fox River Valley industrial district and the lakeshore complex (*24*).[1]

Green Lake County's lakes, streams, and wetlands

[1] Italic numbers in parentheses refer to Literature Cited, p. 130.

have made the county a popular vacation ground for residents of southeastern Wisconsin and out-of-state visitors, mainly from Illinois. Areas near the many lakes and streams are becoming increasingly important as homesites and recreational areas for the expanding populations of southeastern Wisconsin and northern Illinois. Wooded tracts throughout the county are also in demand for these uses (*6*).

Surface relief in the county is the result of glaciation. Topographic features include ground moraines in which low hills and kettles are interspaced with old glacial lakebeds and drainageways. Bedrock escarpments and sand dunes give some diversity to this pattern. The soils formed mainly in materials that were laid down during or shortly after glaciation.

The county can be divided into three physiographic areas by surface features. One of the most interesting and economically important features is the high plain or plateau in the southeastern part of the county. This plain extends north to Green Lake, and a smaller segment is north of the lake. The surface of this plain is generally nearly level and gently sloping. The soils formed in windblown silts and glacial till. They include some of the best farming land in the county. These soils, however, are subject to erosion, and surface crusting often hinders the emergence of small seeded plants.

Underlying this high plateau at a relatively shallow depth are two kinds of bedrock. The upper layer is dolomite, and the lower layer is sandstone. The dolomite is relatively hard and resistant to erosion, but the sandstone is softer. Where the protective dolomite cap has been removed by the forces of geologic erosion, the sandstone, in most places, has also been removed. Escarpments and outcrops of bedrock are scattered throughout the county (fig. 2).

The second physiographic area is in the northwestern part of the county which forms part of the central sand plain of Wisconsin. It is a low, nearly level and gently sloping region of sandy soils and marshland. The well drained and moderately well drained sandy soils are droughty and subject to blowing. The soils in the lower areas are often ponded, unless drained.

The third physiographic area consists of rolling hills and valleys caused almost entirely by glacial deposition. Wet soils, which were glacial lakebeds and drainageways, are interwoven throughout this region. The well drained soils formed mainly in glacial till, but there is a significant sand mantle over much of this region. This sand, which has blown from the central sand plain since glacial times, is generally thickest in the western part of the county and gradually thins to the east. The sandy soils are subject to blowing and are

***Figure 2.*—Quarry exposing dolomite overlying sandstone.**

droughty. If cultivated, the loamy soils that formed in glacial till are subject to erosion. Most of the soils in the low areas are poorly drained or very poorly drained.

Green Lake County has a large acreage that is suitable for farming. For example, nearly level Plano soils in the southeastern part of the county are well suited to intensive crop production. They respond to a high level of management, such as heavy fertilization and other practices that produce a large population of plants. These soils also have potential for producing more specialty crops such as vegetables and other truck crops.

Kidder soils are extensive in the more rolling sections of the county. They are more limited in their response to management than Plano soils because they are not as deep and hold less water available to plants than Plano soils. The nearly level and gently sloping Kidder soils, however, are well suited to irrigation, and where irrigated are well suited to the intensive production of vegetable and truck crops.

In Green Lake County there is a demand for information on nonfarm uses of soils. Information is especially needed for building sites as urban and nonfarm population increases. Many of these soils are well suited to nonfarm uses, but others are not. The construction of homes with private sewage systems is controlled by local and State ordinances to minimize the danger of ground water pollution. To effectively filter the effluent, a deep, loamy, well-drained soil is best. If Knowles, Ripon, and Ritchey soils, which formed over dolomite, are used for onsite sewage systems pollution is a hazard, because natural fissures or crevices in the bedrock permit a rapid downward movement of unfiltered effluent (fig. 3).

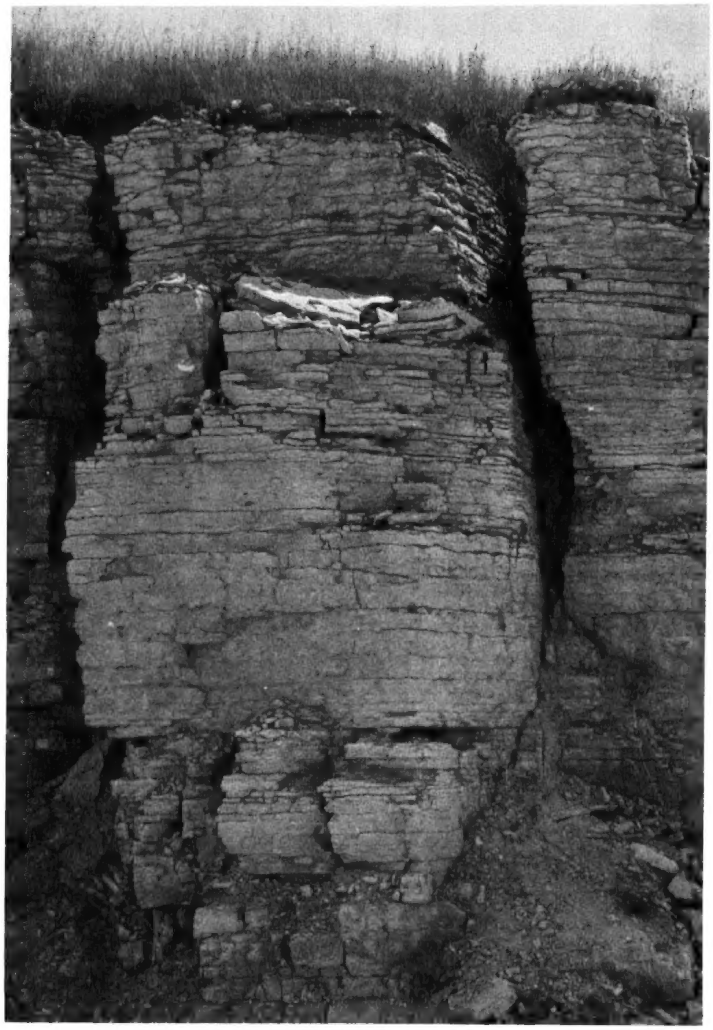

Figure 3.—**Quarry area of dolomite that shows the fissures common in bedrock. The use of Knowles, Ripon, and Ritchey soils for septic tanks is severely limited, because these crevices may permit pollution of the ground water.**

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Green Lake County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Markesan and Ripon, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristics that affect use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Kidder loam, 2 to 6 percent slopes, is one of several phases within the Kidder series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back

of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

An undifferentiated group is made up of two or more soils or land types that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Rock land and Ritchey soils, 6 to 45 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock outcrop is a land type in Green Lake County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and range, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The General Soil Map at the back of this survey shows, in color, the soil associations in the survey area. A soil association is a landscape that has a distinctive pattern of soils in defined proportions. It typically consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations, but in different patterns.

A map showing soil associations is useful to people who want to have a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to locate large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for managing a watershed, a wooded tract, or a wildlife area or for broad planning of recreational facilities, community developments and such engineering works as transportation corridors. It is not a suitable map for detailed planning for management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Green Lake County are described on the pages that follow.

1. Plano-Mendota-St. Charles association

Well drained and moderately well drained, nearly level to sloping soils that have a subsoil mainly of silt loam and silty clay loam underlain by calcareous, gravelly or very gravelly sandy loam glacial till

This association consists of a high plain or plateau of ground moraine that has broad ridgetops and gentle swales. It is on glaciated uplands where the soils formed in windblown silts and the underlying glacial till. The soils are mostly nearly level and gently sloping but are steeper along drainageways and escarpments.

This association makes up about 30 percent of the county. It is about 28 percent Plano soils, 11 percent Mendota soils, 7 percent St. Charles soils, and 54 percent minor soils.

The Plano soils are nearly level and gently sloping and well drained and moderately well drained. They are on broad, slightly convex plains. They have a surface layer of silt loam. Their subsoil is silt loam and silty clay loam in the upper part and heavy sandy loam in the lower part. The substratum is gravelly sandy loam glacial till that begins at a depth of about 58 inches.

The Mendota soils are nearly level to sloping and well drained. They are mostly on low knolls. They have a surface layer of silt loam. Their subsoil is silt loam and heavy silt loam in the upper part and very gravelly loam in the lower part. The substratum is very gravelly sandy loam glacial till that begins at a depth of about 33 inches.

The St. Charles soils are nearly level to sloping and well drained and moderately well drained. They are chiefly on broad ridgetops. They have a surface layer of silt loam. Their subsoil is silt loam and heavy silt loam in the upper part and heavy sandy loam in the lower part. The substratum is gravelly sandy loam glacial till that begins at a depth of about 54 inches.

Of minor extent in this association are the Knowles, LeRoy, Ritchey, Colwood, Joy, Kibbie, Ossian, and Palms soils. LeRoy soils are intermingled with the St. Charles soils where the high plain breaks into major drainageways. Knowles and Ritchey soils are along escarpments where the glacial till is thin over dolomite. Colwood, Joy, Kibbie, Ossian, and Palms soils are in swales and wet drainageways.

The soils of this association have a high potential

for all of the cultivated crops commonly grown in the county. Most of the acreage is used for cultivated crops such as corn, small grains, and legumes, and some is used for canning crops such as sweet corn and peas. A large acreage is also used for dairy farming. A few steeper areas and undrained wet areas are used for pasture or wildlife habitat. A few areas are in woodland.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, and fertility. The wet soils need to be drained if they are to be used for crops.

The major soils of this association that have a slope of less than 6 percent have no serious limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

2. *Kidder-Rotamer-Grellton association*

Well drained and moderately well drained, nearly level to steep soils that have a subsoil mainly of loam, clay loam, and sandy clay loam underlain by calcareous, gravelly sandy loam glacial till

This association consists of ground moraine made up of swales, rounded hills, and drumlins on glaciated uplands. The soils are mostly gently sloping and sloping. In some places, stones and boulders are common on the surface and in the soil.

This association makes up about 27 percent of the county. It is about 23 percent Kidder soils, 5 percent Rotamer soils, 5 percent Grellton soils, and 67 percent minor soils.

The Kidder soils are nearly level to steep and are well drained. They are on ground moraine and drumlins. In most places the surface layer is fine sandy loam; in some places it is loam. The subsoil is loam or fine sandy loam in the upper part, sandy clay loam or clay loam in the middle part, and heavy sandy loam in the lower part. The substratum is gravelly sandy loam glacial till and is at a depth of about 34 inches.

The Rotamer soils are gently sloping to steep and well drained. They also are on ground moraine and drumlins. They have a surface layer of sandy loam, and their subsoil is loam and clay loam in the upper part and sandy loam in the lower part. The substratum is gravelly sandy loam glacial till and is at a depth of about 19 inches.

The Grellton soils are on ground moraine and drumlins. These soils are nearly level to moderately steep and are well drained and moderately well drained. They have a surface layer of fine sandy loam. Their subsoil is loam in the upper part, silt loam in the middle part, and sandy clay loam in the lower part. The substratum is gravelly sandy loam glacial till and is at a depth of about 56 inches.

Some minor soils in this association are Knowles, Lapeer, Oakville, Okee, Ritchey, and Urne soils. Others are Adrian, Barry, Colwood, Houghton, Kibbie, Marcellon, and Palms soils in swales and wet drainageways. Small areas of Lapeer soils are intermingled with the Kidder, Rotamer, and Grellton soils. Knowles, Ritchey, and Urne soils are along escarpments and other areas where the glacial till is thin over dolomite or sandstone bedrock. Oakville and Okee soils are in areas throughout the association where deposits of windblown sand are thick.

The soils of this association are suited to all the cultivated crops grown in the county. Most of the acreage is used for cultivated crops such as corn, small grains, and legumes, and some is used for canning crops such as sweet corn and peas. Some steeper areas and undrained wet areas are used for pasture or wildlife habitat, and some areas are in woods. Much of the acreage is used for dairy farming and raising beef cattle.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, and fertility. The wet soils need to be drained if they are to be used for crops.

The major soils of this association that have a slope of less than 6 percent have no serious limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

3. *Lapeer-Mecan-Okee association*

Well drained and somewhat excessively drained, gently sloping to steep soils that have a subsoil of sandy loam underlain by calcareous, gravelly sandy loam or gravelly loamy sand glacial till

This association consists of ground moraine made up of swales, rounded hills, and drumlins on glaciated uplands (fig. 4). The soils are mostly gently sloping and sloping. In many places, stones and boulders are common on the surface and in the soil.

This association makes up about 7 percent of the county. It is about 18 percent Lapeer soils, 9 percent Mecan soils, 9 percent Okee soils, and 64 percent minor soils.

The Lapeer soils are nearly level to steep and are well drained. They are on ground moraine and drumlins. In most places the surface layer is loamy fine sand; in some places it is fine sandy loam. The subsoil is sandy loam. The substratum is gravelly sandy loam glacial till and is at a depth of about 33 inches.

The Mecan soils are gently sloping and sloping and are somewhat excessively drained. They are on ground moraine and drumlins. They have a surface layer of loamy fine sand. Their subsoil is sandy loam. The substratum is gravelly loamy sand glacial till and is at a depth of about 46 inches.

The Okee soils are gently sloping to moderately steep and are well drained to somewhat excessively drained. They are on ground moraine. They have a surface layer and subsurface layer of loamy fine sand. Their subsoil is sandy loam. The substratum is gravelly sandy loam glacial till and is at a depth of about 45 inches.

Some minor soils in this association are Gotham, Kidder, Oakville, Rotamer, and Urne soils. Others are Adrian, Brems, Granby, and Houghton soils in swales and wet drainageways. Rotamer and Kidder soils are intermingled with Lapeer, Mecan, and Okee soils. Gotham and Oakville soils are in areas where there are deposits of windblown sand. Urne soils are along escarpments and in other areas where the glacial till is thin over sandstone bedrock.

The soils of this association are suited to all the

Figure 4.—Typical area of the Lapeer-Mecan-Okee association.

general farm crops grown in the county, but in an average year crop yields are limited by the available water capacity. Much of the acreage is used for cultivated crops such as corn, small grains, and legumes. Some areas are used for pasture and wildlife habitat, especially steeper areas and undrained wet areas. Small woodlots are common. Much of the acreage is used for dairy farming and raising beef cattle.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining the level of organic matter, tilth, available water, and fertility. Stones and boulders interfere with tillage in much of this association. The wet soils need to be drained if they are to be used for general farm crops.

The major soils of this association that have a slope of less than 6 percent have no serious limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

4. Oakville-Brems-Granby association

Well drained, moderately well drained, and poorly drained, nearly level to steep soils that have a subsoil of fine sand underlain by fine and medium sand

This association consists of low hills and swales on outwash plains and terraces. The soils are mostly nearly level and gently sloping.

This association makes up about 9 percent of the county. It is about 17 percent Oakville soils, 16 percent Brems soils, 14 percent Granby soils, and 53 percent minor soils.

The Oakville soils are nearly level to steep and are well drained. They are on outwash plains and terraces. They have a surface layer of fine sand. Their subsoil is fine sand. The substratum is fine sand in the upper part and medium sand in the lower part. It is at a depth of about 33 inches.

The Brems soils are nearly level and gently sloping and are moderately well drained. They are on outwash plains and terraces. They have a surface layer of loamy fine sand. Their subsoil is fine sand. The substratum is medium sand and is at a depth of about 38 inches.

The Granby soils are nearly level and poorly drained. They are on outwash plains and terraces. They have a surface layer of loamy fine sand. Their subsoil is fine sand. The substratum is fine sand and is at a depth of about 35 inches.

Of minor extent in this association are the Kidder and Okee soils on isolated glacial till knolls. Other minor soils are Adrian, Brems, Granby loamy subsoil variant, Houghton, Marshan, Palms, and Poy soils in swales and wet drainageways. Brems soils are intermingled with Oakville soils throughout the association.

Unless the soils of this association are intensively

managed, they are better suited to pasture, woodland, or wildlife habitat than to cultivated crops. Much of the acreage is, in fact, used for pasture, woodland, and wildlife habitat. Some areas are used for cultivated crops such as corn, small grains, and legumes, but many areas which were once farmed are now idle or have been planted to pine trees.

In cultivated areas, the main concerns of management are controlling soil blowing and maintaining the organic-matter content, fertility, and adequate drainage. The wet soils need to be drained if they are to be used for general farm crops.

Oakville soils that have a slope of less than 6 percent have slight limitations for use as sites for housing, septic tank absorption fields, and roads and streets. Where these soils are used for septic tank absorption fields, there is a danger of contaminating ground water supplies. Oakville soils have severe limitations for use as sanitary landfills. Brems and Granby soils have severe limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

5. *Boyer-Oshtemo-Gotham association*

Well drained and somewhat excessively drained, nearly level to steep soils that have a subsoil mainly of loamy fine sand, sandy loam, and loamy sand underlain by sand or stratified sand and gravel outwash

This association consists of low hills and swales and occasional kettle holes on outwash plains and terraces. The soils are mostly gently sloping but are steeper along drainageways and the edges of kettle holes.

This association makes up about 6 percent of the county. It is about 11 percent Boyer soils, 11 percent Oshtemo soils, 11 percent Gotham soils, and 67 percent minor soils.

The Boyer soils are nearly level to steep and are well drained. They are on outwash plains and terraces. They have a surface layer of loamy fine sand. Their subsoil is loamy fine sand in the upper part, sandy loam and light sandy clay loam in the middle part, and loamy sand in the lower part. The substratum is stratified sand and gravel outwash and is at a depth of about 32 inches.

The Oshtemo soils are nearly level to sloping and are well drained. They are on outwash plains and terraces. They have a surface layer of loamy fine sand. Their subsoil is loamy fine sand in the upper part, sandy loam in the middle part, and loamy sand in the lower part. The substratum is outwash sand and is at a depth of about 62 inches.

The Gotham soils are nearly level to sloping and are well drained and somewhat excessively drained. They are on outwash plains and terraces. They have a surface layer of loamy fine sand, and their subsoil is loamy fine sand in the upper part and medium sand in the lower part. The substratum is outwash sand and is at a depth of about 34 inches.

Of minor extent in this association are Brems, Kidder, Oakville, Okee, Richford, Rodman, and Sisson soils. Brems, Oakville, and Richford soils are intermingled with Gotham soils. Sisson soils are intermingled with Boyer and Oshtemo soils in some places. Rodman soils are in steeper areas where the soil is thin over outwash. Kidder and Okee soils are on isolated glacial till knolls. Adrian, Colwood, Granby, Granby loamy subsoil variant, Houghton, and Kibbie soils are minor soils in swales and wet drainageways.

The soils of this association are suited to all the general farm crops grown in the county, but in an average year, crop yields are limited by the available water capacity. Much of the acreage is used for cultivated crops such as corn, small grains, and legumes. Some of the steeper areas and undrained wet areas are used for pasture and wildlife habitat. Small woodlots are common. Much of the acreage is used for dairy farming and raising beef cattle. Some areas are a source of sand and gravel.

In cultivated areas, the main concerns of management are controlling erosion and soil blowing and maintaining organic-matter content, tilth, available water, and fertility. The wet soils need to be drained if they are to be used for the general farm crops.

The major soils of this association that have a slope of less than 6 percent have slight limitations for use as sites for housing, septic tank absorption fields, and local roads and streets. They have severe limitations for use as sanitary landfills.

6. *Willette-Poy-Poygan association*

Very poorly drained and poorly drained, nearly level organic soils and soils that have a subsoil of silty clay and clay underlain by sand or calcareous clay and silty clay

This association is in drainageways and old lake basins and on flood plains.

This association makes up about 11 percent of the county. It is about 19 percent Willette soils, 17 percent Poy soils, 13 percent Poygan soils, and 51 percent minor soils.

The Willette soils are nearly level and very poorly drained. They are on flood plains and in drainageways and old lake basins. They have an organic layer of well decomposed muck about 30 inches thick. The substratum is silty clay and clay.

The Poy soils are nearly level and poorly drained. They are on flood plains and in swales, drainageways, and old lake basins. The surface layer is silty clay loam in the upper part and silty clay in the lower part. The subsoil is clay in the upper part and silty clay in the lower part. The substratum is fine sand and is at a depth of about 36 inches.

The Poygan soils are nearly level and poorly drained. They are on flood plains and in swales, drainageways, and old lake basins. The surface layer is silty clay loam in the upper part and silty clay in the lower part. The subsoil is clay in the upper part and silty clay in the lower part. The substratum is silty clay and is at a depth of about 33 inches.

Of minor extent in this association are the Brems, Briggsville, Oakville, and Tustin soils. Brems, Oakville, and Tustin soils are in areas where deposits of windblown sand are thick. Briggsville soils are in old glacial lake basins, especially in the northeastern part of the association. Adrian, Colwood, Granby, Granby clayey subsoil variant, Houghton, Kibbie, Manawa, Marshan, and Zittau soils are on flood plains and in swales, wet drainageways, and old lake basins.

Most of the acreage is used for wildlife habitat and

some is used for pasture. Small areas of woodland are common. The major soils of this association are too wet for cultivated crops, unless they are drained. Where drained, they are generally used to grow corn. Better drained areas of the minor soils in this association are used for corn, small grains, and legumes.

In cultivated areas, the main concern of management is maintaining adequate drainage, tilth, and fertility.

The major soils of this association have severe and very severe limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

7. *Adrian-Houghton association*

Very poorly drained, nearly level organic soils underlain by sandy, loamy, or clayey material or marl

This association is in drainageways, depressions, and old lake basins and on flood plains (fig. 5).

This association makes up about 10 percent of the county. It is about 29 percent Adrian soils, 29 percent Houghton soils, and 42 percent minor soils.

The Adrian soils are nearly level and very poorly drained. They are in drainageways, depressions, and old lake basins and on flood plains. They have an organic layer of highly decomposed muck about 36 inches thick. The substratum is outwash sand.

The Houghton soils are nearly level and very poorly drained. They are in drainageways, depressions, and old lake basins and on flood plains. The organic layer is highly decomposed muck more than 51 inches thick. The substratum is sandy, clayey, or loamy material or marl.

Some minor soils in this association are Brems, Kidder, and Oakville soils. Brems and Oakville soils are on sand knolls intermingled with Adrian and Houghton soils. Kidder soils are on isolated glacial till knolls in some parts of the association. Colwood, Granby, and Palms soils are intermingled with Adrian and Houghton soils.

The soils of this association are too wet for cultivated crops unless they are drained. Where adequately drained, they are well suited to specialty crops such as lettuce, carrots, and mint. Most of the acreage is used for wildlife habitat. Drained areas are generally used for corn, and some areas are used to grow mint.

In cultivated areas, the main concerns of management are maintaining adequate but not excessive drainage, protecting against rapid subsidence and soil blowing, and maintaining fertility.

Figure 5.—**Typical area of the Adrian-Houghton association. Houghton soils are in the foreground. Adrian soils are adjacent to the well-drained uplands in the background. Mint and other specialty crops are grown in some areas.**

The major soils of this association have very severe limitations for use as sites for housing, septic tank absorption fields, roads and streets, and sanitary landfills.

Descriptions of the Soils

This section describes the soil series and mapping units in Green Lake County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in detail is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land, wet, for example, does not belong to a soil series, but it is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, woodland group, recreation group, wildlife group, and tree and shrub group in which the mapping unit has been placed. The page for the description of each interpretative group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*21*).

Adrian Series

The Adrian series consists of nearly level, very poorly drained soils on flood plains and in drainageways, depressions, and old glacial lake basins. These soils are organic and are underlain by sand. The native vegetation was marsh vegetation such as sedges, reeds, and grasses; shrubs such as willow, alder, and dogwood; and trees such as tamarack. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black nonsticky muck about 36 inches thick. The content of plant fibers increases in the lower part. The substratum is grayish-brown, loose fine sand to a depth of 60 inches.

The available water capacity is high. Permeability is rapid in the organic layer and rapid in the substratum. Root penetration is limited by the water table or, in drained areas, by the underlying sand. Natural fertility is low.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Adrian muck, approximately 1,300 feet east and 500 feet north of the southwest corner of sec. 5, T. 15 N., R. 12 E., in a formerly cultivated field:

Oap—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; moderate, fine and very fine, granular structure; nonsticky; mainly herbaceous fibers; slightly acid; abrupt, smooth boundary.

Oa2—8 to 16 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; moderate, fine and very fine, granular structure; nonsticky; mainly herbaceous fibers; slightly acid; clear, smooth boundary.

Oa3—16 to 21 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; moderate, thin, platy structure; nonsticky; mainly herbaceous fibers; neutral; clear, wavy boundary.

Oa4—21 to 25 inches, black (N 2/0, broken face and rubbed) sapric material; about 15 percent fiber, less than 5 percent rubbed; weak, thick platy structure; nonsticky; mainly herbaceous fibers; slightly acid; clear, wavy boundary.

Oa5—25 to 32 inches, black (N 2/0 broken face, 10YR 2/1 rubbed) sapric material; about 30 percent fiber, less than 5 percent rubbed; moderate, thin, platy structure; nonsticky; mainly herbaceous fibers; neutral; clear, wavy boundary.

Oe1—32 to 36 inches, black (N 2/0, broken face and rubbed) hemic material; about 60 percent fiber, 30 percent rubbed; weak, thin, platy structure; nonsticky; mainly herbaceous fibers; neutral; clear, smooth boundary.

IIC—36 to 60 inches, grayish-brown (10YR 5/2) fine sand; single grained; loose; some black (N 2/0) organic fibers; neutral.

The organic layer ranges from 16 to 50 inches in thickness. The organic part of the subsurface and bottom tiers is mainly sapric material. Some pedons, however, have thin layers of hemic material that have a combined thickness of less than 10 inches. The organic material is mainly herbaceous, but a few woody fragments ranging from ⅛ inch to several inches in diameter are mixed with the organic material in some places. The IIC horizon is fine or medium sand.

Adrian soils are near Granby, Houghton, and Marshan soils. Adrian soils have a thinner organic layer than Houghton soils. They have a 16- to 50-inch thick organic layer that the Granby and Marshan soils lack.

Ad—Adrian muck. This soil is nearly level and is on flood plains and in drainageways, depressions, and old glacial lake basins. The areas of this soil are elongated to irregular in shape and cover 5 to 500 acres. Many areas are between areas of Houghton soils and the surrounding mineral soils. Slope is 0 to 2 percent.

Included with this soil in mapping are small areas of Granby, Houghton, Palms, and Willette soils. Also included are some areas where the organic layer is less than 16 inches thick and areas that have as much as 16 inches of sandy or loamy overwash. Some small areas

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Adrian muck	9,300	4.1	Marcellon loam, 0 to 3 percent slopes	2,000	0.9
Alluvial land, wet	870	.4	Markesan silt loam, 2 to 6 percent slopes, eroded	530	.2
Barry loam	1,550	.7	Markesan silt loam, 6 to 12 percent slopes, eroded	1,350	.6
Boyer loamy fine sand, 1 to 6 percent slopes	2,800	1.2	Markesan silt loam, 12 to 20 percent slopes, eroded	240	.1
Boyer loamy fine sand, 6 to 12 percent slopes, eroded	1,500	.7	Marsh	580	.3
Boyer loamy fine sand, 12 to 25 percent slopes	660	.3	Marshan silt loam	3,900	1.7
Brems loamy fine sand, 0 to 6 percent slopes	8,700	3.8	Mecan loamy fine sand, 2 to 6 percent slopes	1,900	.8
Briggsville silt loam, 0 to 2 percent slopes	320	.1	Mecan loamy fine sand, 6 to 12 percent slopes, eroded	560	.2
Briggsville silt loam, 2 to 6 percent slopes	780	.3	Mendota silt loam, 0 to 2 percent slopes	730	.3
Colwood silt loam	4,350	1.9	Mendota silt loam, 2 to 6 percent slopes	6,500	2.9
Dodge silt loam, 2 to 6 percent slopes	1,260	.6	Mendota silt loam, 6 to 12 percent slopes, eroded	500	.2
Dodge silt loam, 6 to 12 percent slopes, eroded	570	.3	Oakville fine sand, 1 to 6 percent slopes	5,600	2.5
Edwards muck	195	.1	Oakville fine sand, 6 to 12 percent slopes	1,500	.7
Friesland loam, 0 to 2 percent slopes	960	.4	Oakville fine sand, 12 to 35 percent slopes	375	.2
Friesland loam, 2 to 6 percent slopes	1,550	.7	Okee loamy fine sand, 1 to 6 percent slopes	5,900	2.6
Gotham loamy fine sand, 1 to 6 percent slopes	2,150	.9	Okee loamy fine sand, 6 to 15 percent slopes	1,300	.6
Gotham loamy fine sand, 6 to 12 percent slopes	550	.2	Oshtemo loamy fine sand, 1 to 6 percent slopes	1,550	.7
Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes	285	.1	Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded	350	.2
Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes	215	.1	Ossian silt loam	5,500	2.4
Granby loamy fine sand	11,000	4.8	Palms muck	3,100	1.4
Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes	4,000	1.8	Plano silt loam, 0 to 2 percent slopes	13,700	6.0
Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes	2,950	1.3	Plano silt loam, 2 to 6 percent slopes	7,800	3.4
Grellton fine sandy loam, 0 to 2 percent slopes	760	.3	Poy silty clay loam	5,400	2.4
Grellton fine sandy loam, 2 to 6 percent slopes	3,550	1.6	Poygan silty clay loam	3,850	1.7
Grellton fine sandy loam, 6 to 12 percent slopes, eroded	1,400	.6	Richford loamy sand, 1 to 6 percent slopes	940	.4
Grellton fine sandy loam, 12 to 20 percent slopes, eroded	455	.2	Richford loamy sand, 6 to 15 percent slopes	410	.2
Griswold silt loam, 0 to 2 percent slopes	255	.1	Ripon silt loam, 1 to 6 percent slopes	360	.2
Griswold silt loam, 2 to 6 percent slopes	2,300	1.0	Ritchey silt loam, 2 to 6 percent slopes, eroded	530	.2
Griswold silt loam, 6 to 12 percent slopes, eroded	1,100	.5	Ritchey silt loam, 6 to 12 percent slopes, eroded	870	.4
Houghton muck	12,500	5.5	Ritchey silt loam, 12 to 20 percent slopes, eroded	690	.3
Joy silt loam, 0 to 3 percent slopes	1,900	.8	Rock land and Ritchey soils, 6 to 45 percent slopes	1,400	.6
Kibbie loam, 0 to 3 percent slopes	2,050	.9	Rock outcrop	175	.1
Kidder fine sandy loam, 0 to 2 percent slopes	690	.3	Rodman gravelly sandy loam, 6 to 20 percent slopes	390	.2
Kidder fine sandy loam, 2 to 6 percent slopes	13,100	5.8	Rodman gravelly sandy loam, 20 to 35 percent slopes	265	.1
Kidder fine sandy loam, 6 to 12 percent slopes, eroded	3,700	1.6	Rotamer sandy loam, 2 to 6 percent slopes, eroded	2,150	.9
Kidder fine sandy loam, 12 to 20 percent slopes, eroded	750	.3	Rotamer sandy loam, 6 to 12 percent slopes, eroded	3,900	1.7
Kidder loam, 0 to 2 percent slopes	250	.1	Rotamer sandy loam, 12 to 20 percent slopes, eroded	1,600	.7
Kidder loam, 2 to 6 percent slopes	4,700	2.1	Rotamer sandy loam, 20 to 30 percent slopes	200	.1
Kidder loam, 6 to 12 percent slopes, eroded	2,250	1.0	St. Charles silt loam, 0 to 2 percent slopes	1,450	.6
Kidder loam, 12 to 20 percent slopes, eroded	750	.3	St. Charles silt loam, 2 to 6 percent slopes	3,300	1.5
Kidder loam, 20 to 30 percent slopes	360	.2	St. Charles silt loam, 6 to 12 percent slopes, eroded	720	.3
Knowles silt loam, 0 to 2 percent slopes	260	.1	Sisson loam, 2 to 6 percent slopes	580	.3
Knowles silt loam, 2 to 6 percent slopes	2,000	.9	Sisson loam, 6 to 12 percent slopes, eroded	265	.1
Knowles silt loam, 6 to 12 percent slopes, eroded	720	.3	Sisson loam, 12 to 20 percent slopes, eroded	185	.1
Knowles silt loam, 12 to 20 percent slopes, eroded	420	.2	Tustin loamy fine sand, 1 to 6 percent slopes	750	.3
Lapeer loamy fine sand, 2 to 6 percent slopes	4,450	2.0	Urne loamy fine sand, 2 to 6 percent slopes	300	.1
Lapeer loamy fine sand, 6 to 12 percent slopes, eroded	2,250	1.0	Urne loamy fine sand, 6 to 12 percent slopes, eroded	255	.1
Lapeer loamy fine sand, 12 to 25 percent slopes, eroded	860	.4	Urne loamy fine sand, 12 to 30 percent slopes, eroded	345	.2
Lapeer fine sandy loam, 0 to 2 percent slopes	270	.1	Willette muck	4,700	2.1
LeRoy silt loam, 6 to 12 percent slopes, eroded	670	.3	Zittau silty clay loam, 0 to 3 percent slopes	450	.2
LeRoy silt loam, 12 to 20 percent slopes, eroded	245	.1	Quarries and gravel pits	346	.2
Lomira silt loam, 2 to 6 percent slopes	1,650	.7	Total	226,816	100.0
Lomira silt loam, 6 to 12 percent slopes, eroded	620	.3			
Lomira silt loam, 12 to 20 percent slopes, eroded	245	.1			
Manawa silt loam, 0 to 3 percent slopes	580	.3			

have sandy, loamy, or clayey layers in the organic layer or have loamy or clayey layers in the underlying sand.

Runoff is very slow and is likely to pond during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage, but precautions must be taken to prevent loose sand from entering the tile lines. Cultivated areas of this soil are subject to soil blowing and burning. If the water table is lowered excessively in such areas, the organic matter decomposes very rapidly and subsidence becomes a problem.

Where this soil is drained, it is suitable for vegetable crops such as beets, carrots, and lettuce. Undrained areas are suitable for wetland wildlife habitat. Drained areas are used for corn. Some undrained areas are used for unimproved pasture. Capability unit IVw–7; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

Alluvial Land, Wet

An—Alluvial land, wet. This mapping unit consists of nearly level, poorly drained, recent stream deposits on flood plains and along the edges of lakes. Areas are generally elongated and cover 5 to 80 acres. Unless these soils are drained, ground water is at or near the surface throughout the year.

This soil has a wide range of profile characteristics. The surface layer ranges from sand to silt loam, and in some areas it is organic. The substratum is stratified sandy and loamy deposits that have strata of organic soil in some places. The vegetation is mainly marsh grasses, but some areas are in trees.

Included in mapping are small areas of Adrian, Marshan, and Palms soils and Marsh. Also included are small areas of somewhat poorly drained alluvium.

Alluvial land, wet, is subject to frequent flooding and in many places is dissected by streams, old stream channels, sloughs, and oxbows. It is best suited to wetland wildlife habitat. Some areas are used as a source of marsh hay and some are used for unimproved pasture. Capability unit Vw–14; woodland group 4w2; recreation group 7; wildlife group 7; tree and shrub group 3.

Barry Series

The Barry series consists of nearly level, poorly drained soils in drainageways and depressions on the till plains and along the edge of flood plains and old glacial lake basins. These soils are loamy and are underlain by gravelly loamy sand or gravelly sandy loam glacial till. The native vegetation was mainly marsh grasses and shrubs and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is about 13 inches thick. It is black loam in the upper part and very dark grayish-brown heavy loam in the lower part. The surface layer has brown and yellowish-brown mottles. The subsoil is about 18 inches thick. It is dark grayish-brown, firm clay loam in the upper part and light brownish-gray and brown, friable sandy loam in the lower part. The subsoil has yellowish-brown mottles. The substratum is yellowish-brown, very friable gravelly loamy sand to a depth of 60 inches and has light brownish-gray mottles.

The available water capacity is high, and permeability is moderate. Root penetration is limited by the water table. Natural fertility is high. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, pasture, and hay. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Barry loam, approximately 430 feet east and 950 feet north of the southwest corner of the SE¼ of sec. 23, T 16 N., R. 11 E., in an uncultivated wetland:

A11—0 to 8 inches, black (10YR 2/1) loam; few, fine, distinct, brown (10YR 4/3) mottles; moderate, medium, granular structure; very friable; few roots; common pores; slightly acid; abrupt, smooth boundary.

A12—8 to 10 inches, black (10YR 2/1) loam; common, fine, distinct, brown (10YR 4/3) mottles; weak, medium, granular structure; very friable; few roots; common pores; slightly acid; clear, smooth boundary.

A13—10 to 13 inches, very dark grayish-brown (10YR 3/2) heavy loam; common, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; very friable; few roots; common pores; neutral; clear, smooth boundary.

B2tg—13 to 24 inches, dark grayish-brown (10YR 4/2) clay loam; many, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; many thin clay films on faces of most peds; few roots; common pores; neutral; gradual, smooth boundary.

B3tg—24 to 31 inches, mixed, light brownish-gray (10YR 6/2) and brown (10YR 4/3) sandy loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; few roots; common pores; few thin clay films on faces of most peds; clay bridging between sand grains and clay flows in some old root channels; mildly alkaline; clear, wavy boundary.

C—31 to 60 inches, yellowish-brown (10YR 5/6) gravelly loamy sand; many, medium, prominent, light brownish-gray (10YR 6/2) mottles; massive; very friable; about 15 percent, by volume, is gravel; slight effervescence; moderately alkaline.

The solum is 24 to 40 inches thick and overlies calcareous, gravelly sandy loam or loamy sand till. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 15 inches thick. The B2t horizon is heavy loam, clay loam, or sandy clay loam. The C horizon is loamy sand, gravelly loamy sand, sandy loam, or gravelly sandy loam. Coarse fragments, including cobbles and boulders, range from 5 to 35 percent, by volume.

Barry soils are near Colwood, Marcellon, and Palms soils. They are underlain by gravelly loamy sand till, and Colwood soils are underlain by stratified silt loam, silt, fine sand, and very fine sand lacustrine deposits. They are poorly drained, and Marcellon soils are somewhat poorly drained. They lack the 16- to 50-inch organic layer that is characteristic of Palms soils.

Bb—Barry loam. This soil is nearly level and is in the drainageways and depresssions of till plains and along the edge of flood plains and old glacial lake basins. Most areas are elongated and cover 3 to 40 acres.

Included with this soil in mapping are small areas of Granby, Marcellon, and Palms soils. Also included are small areas of this soil where slopes are as much as 4 percent and small areas where the soil is less than 24 inches thick over gravelly loamy sand. In some small areas, the surface layer is loamy sand or sandy loam. In

some places, this soil has cobbles and boulders on the surface and throughout the surface layer and subsoil.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded during the wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

If drained, this soil is suitable for some vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn, small grains, pasture, and legumes. Some undrained areas are used for unimproved pasture. Capability unit IIw–1; woodland group 4w2; recreation group 7; wildlife group 7; tree and shrub group 3.

Boyer Series

The Boyer series consists of nearly level to steep, well-drained soils on outwash plains and terraces. These soils have a sandy and loamy subsoil underlain by stratified sand and gravel. The native vegetation is mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 8 inches thick (fig. 6). The subsoil is about 24 inches thick. It is brown, very friable loamy fine sand in the upper part; brown, firm, heavy sandy loam and light sandy clay loam in the middle part; and dark yellowish-brown, very friable loamy sand in the lower part. The substratum is brown, loose, stratified sand and gravel to a depth of 60 inches.

The available water capacity is low, and permeability is moderately rapid. The growth of roots is restricted by sand and gravel. Natural fertility is low. The organic-matter content of the surface layer is low.

Most areas of nearly level to sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep soils are used for hay, pasture, woodland, or wildlife habitat. There are gravel pits in some areas of these soils. The underlying deposits are a good source of sand and gravel.

Representative profile of Boyer loamy fine sand, 1 to 6 percent slopes, approximately 930 feet west and 90 feet south of the northeast corner of the NW¼ of sec. 2, T. 14 N., R. 11 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy fine sand; very weak, medium, subangular blocky structure; very friable; common roots; common pores; medium acid; abrupt, smooth boundary.

B1t—8 to 14 inches, brown (7.5YR 4/4) loamy fine sand; weak, medium, subangular blocky structure; very friable; common roots; common pores; some clay bridging between sand grains; some dark grayish-brown (10YR 4/2) soil from the Ap horizon in root and worm channels; slightly acid; clear, wavy boundary.

B21t—14 to 21 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; firm; common roots; common pores; many thin clay films on faces of peds and in pores and channels; slightly acid; gradual, wavy boundary.

B22t—21 to 27 inches, brown (7.5YR 4/4) light sandy clay loam; weak, medium, subangular blocky structure; firm; few roots; common pores; many thin clay films on faces of peds and in pores and channels; slightly acid; clear, smooth boundary.

IIB3—27 to 32 inches, dark yellowish-brown (10YR 4/4) light loamy sand; very weak, coarse, subangular blocky structure; very friable; few roots; slightly acid; clear, wavy boundary.

IIC—32 to 60 inches, brown (10YR 5/3) stratified sand and gravel; single grained; loose; strong effervescence; moderately alkaline.

Figure 6.—**Profile of a Boyer soil underlain by stratified sand and gravel at a depth of about 24 inches.**

The solum is 24 to 40 inches thick and overlies sand and gravel. The Ap horizon is dark yellowish brown, dark grayish brown, or very dark grayish brown and is 6 to 9 inches thick. The B2t horizon is as much as 25 percent gravel, by volume.

Boyer soils are near Oshtemo and Rodman soils. They have a thinner solum than Oshtemo soils. They have a thicker solum and are less gravelly in the upper part of the solum than Rodman soils.

BpB—Boyer loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces. Areas are irregular in shape and cover 5 to 120 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Gotham and Oakville soils and of more sloping Boyer loamy fine sand. In some places the surface layer is sandy loam or sand or is gravelly. In places the soil has 20 to 40 inches of sand on the surface, or it is underlain by gravelly sandy loam till.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing. Crop yields during most seasons are limited because the soil has low available water capacity.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and to certain vegetable crops. Most of the acreage is used for general farm crops but some is in native woodland and some has been planted to pine trees.

The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling soil blowing. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production. Capability unit IIIs–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 2.

BpC2—Boyer loamy fine sand, 6 to 12 percent slopes, eroded. This soil is sloping and is on the low ridges and knobs and along drainageways of the outwash plains and terraces. Areas are irregular in shape and cover 5 to 40 acres.

This soil has a surface layer that is about 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Gotham and Oakville soils and small areas of gently sloping or moderately steep, uneroded Boyer loamy fine sand. In some places the surface layer is sandy loam or sand or it is gravelly. Some small areas have 20 to 40 inches of sand on the surface or are underlain by gravelly sandy loam till.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing. Crop yields during most seasons are limited because the soil has low available water capacity.

Where managed properly, this soil is suitable for all of the farm crops commonly grown in the county. Most of the acreage is used for general farm crops, but some areas are in native woodland and some have been planted to pine trees.

The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff and controlling erosion and soil blowing. Capability unit IIIe–7; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 2.

BpD—Boyer loamy fine sand, 12 to 25 percent slopes. This soil is moderately steep and steep and is on the ridges and knobs and along drainageways of the outwash plains and terraces. Most areas are elongated and cover 5 to 25 acres.

This soil has a surface layer that is slightly darker and the surface layer and subsoil combined are about 4 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Oakville, Oshtemo, and Rodman soils and small areas of sloping and moderately eroded Boyer loamy fine sand. Where slopes are complex, there are small areas of wet soils. In some places the surface layer is sandy loam or sand or it is gravelly. Some small areas have 20 to 40 inches of sand on the surface or have gravel throughout the surface layer and subsoil, or are underlain by gravelly sandy loam till.

Runoff is medium, and the hazard of erosion is severe. This soil is subject to soil blowing. The low available water capacity limits crop yields during most seasons.

This soil is not suited to row crops unless erosion is controlled. It is better suited to close-growing crops and woodland.

Most of the acreage is used for hay, pasture, or native woodland. Some areas have been planted to pine trees. Row crops are grown in some of the less sloping areas, but many areas that were cultivated are now in pasture or woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–7; woodland group 3r1; recreation group 2; wildlife group 1; tree and shrub group 2.

Brems Series

The Brems series consists of nearly level and gently sloping, moderately well drained soils on flood plains and in depressions and old glacial lake basins. These soils are sandy and are underlain by sand. The native vegetation was dominantly hardwoods such as elm, soft maple, hickory, and ash. Unless these soils are drained, they are saturated with water to within 2 to 3 feet of the surface during wet periods.

In a representative profile the surface layer is very dark brown loamy fine sand about 9 inches thick. The subsoil is yellowish-brown, loose fine sand about 29 inches thick. It is mottled with yellowish-brown, strong brown, light brownish gray, dark reddish brown, dark red, and yellowish red. The substratum is pale-brown, loose medium sand to a depth of 60 inches. It has yellowish-red mottles.

The available water capacity is low, and permeability is very rapid. The depth of root penetration is limited by saturated soil during wet periods. Natural fertility is low. The organic-matter content of the surface layer is low.

Many areas are used for corn, small grains, pasture, or hay. The wetter, undrained areas provide good wildlife habitat and some are used for unimproved pasture.

Representative profile of Brems loamy fine sand, 0 to 6 percent slopes, approximately 400 feet east and 330 feet north of the center of sec. 13, T. 15 N., R. 11 E., in a cultivated field:

Ap—0 to 9 inches, very dark brown (10YR 2/2) loamy fine sand; weak, fine and very fine, granular structure, single grained where disturbed; very friable; common roots; common pores; medium acid; abrupt, smooth boundary.

B1—9 to 14 inches, yellowish-brown (10YR 5/4) fine sand; few, fine, distinct, yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure, single grained where disturbed; loose; few roots; many pores; medium acid; clear, smooth boundary.

B21—14 to 18 inches, yellowish-brown (10YR 5/4) fine sand; common, fine, distinct, strong-brown (7.5YR 5/6) mottles and few, fine, distinct, dark reddish-brown (5YR 3/4) and light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure, single grained where disturbed; loose;

few roots; many pores; medium acid; clear, wavy boundary.

B22—18 to 27 inches, yellowish-brown (10YR 5/6) fine sand; few, fine, prominent, dark-red (2.5YR 3/6) and distinct, dark reddish brown (5YR 3/4) mottles and common, medium, faint, strong-brown (7.5YR 5/6) mottles; single grained; loose; few roots; medium acid; gradual, wavy boundary.

B23—27 to 32 inches, yellowish-brown (10YR 5/6) fine sand; common, medium, distinct, yellowish-red (5YR 4/8) mottles; single grained; loose; few roots; medium acid; clear, wavy boundary.

B3—32 to 38 inches, yellowish-brown (10YR 5/6) fine sand; common, medium, distinct, yellowish-brown (10YR 5/8) mottles and few, fine, distinct, yellowish-red (5YR 4/8) mottles; single grained; loose; slightly acid; clear, wavy boundary.

C—38 to 60 inches, pale-brown (10YR 6/3) medium sand; few, fine, prominent, yellowish-red (5YR 4/8) mottles; single grained; loose; slightly acid.

The solum is 24 to 55 inches thick. The A1 or Ap horizon is very dark brown, very dark gray, very dark grayish brown, or dark brown and is 3 to 9 inches thick. The B2 horizon is loamy fine sand or fine sand 10 to 26 inches thick. The C horizon is sand or fine sand.

Brems soils are near Granby and Oakville soils. Brems soils are moderately well drained, Granby soils are poorly drained, and Oakville soils are well drained.

BrB—Brems loamy fine sand, 0 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces and in old glacial lake basins. Most areas are elongated to irregular in shape and cover 3 to 50 acres.

Included with this soil in mapping are small areas of Granby soils. Some small areas have a fine sand surface layer. Some small areas have thin loamy or clayey strata in the subsoil and the substratum. Also included are areas where the substratum is stratified silt and fine sand, or is sand underlain by loamy or clayey deposits below a depth of 50 inches, or is gravelly.

Runoff is slow. The hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Early spring plantings, before the soil has a chance to dry, are best for this soil.

This soil is suited to irrigation. With fertilization, supplemental irrigation, and protection from soil blowing, it can be used for farm crops and certain vegetable crops. Most of the acreage is used for pasture, woodland, and wildlife habitat, but some areas are used for crops. Some areas have been planted to pine trees.

The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling soil blowing. Capability unit IVs–3; woodland 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

Briggsville Series

The Briggsville series consists of nearly level and gently sloping, well drained and moderately well drained soils on old glacial lake basins. These soils have a clayey subsoil underlain by stratified lacustrine silty clay loam, silty clay, and clay. The native vegetation was mixed hardwood forest. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is very dark grayish-brown silt loam about 8 inches thick. The subsurface layer is light brownish-gray silt loam about 3 inches thick. The subsoil is about 23 inches thick. It is reddish-brown, firm silty clay loam in the upper part and reddish-brown, firm silty clay in the lower part. The substratum is reddish-brown, firm stratified silty clay loam, silty clay, and clay to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderately slow. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Briggsville silt loam, 0 to 2 percent slopes, approximately 585 feet east and 925 feet south of the northwest corner of the NE¼ of sec. 2, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silt loam, light brownish-gray (10YR 6/2) when dry; weak, fine and medium, granular structure; very friable; common roots; common pores; neutral; abrupt, smooth boundary.

A2—8 to 11 inches, light brownish-gray (10YR 6/2) silt loam; weak, medium, platy structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; neutral; abrupt, smooth boundary.

B1—11 to 13 inches, reddish-brown (5YR 4/4) silty clay loam; weak, medium, subangular blocky structure; firm; few roots; common pores; bleached silt particles on faces of most peds and thin patchy clay films on faces of some peds; medium acid; clear, smooth boundary.

B22t—13 to 30 inches, reddish-brown (5YR 4/3) silty clay; moderate, fine and medium, angular blocky structure; firm; few roots; common pores; bleached silt particles on vertical faces of peds and thin continuous clay films on faces of peds; medium acid; gradual, smooth boundary.

B23t—30 to 34 inches, reddish-brown (5YR 4/3) silty clay; weak, medium, prismatic structure parting to moderate, fine and medium, angular blocky; firm; few roots; common pores; thin continuous clay films on faces of peds; strongly acid; gradual, smooth boundary.

C—34 to 60 inches, reddish-brown (5YR 5/3) stratified silty clay loam, silty clay, and clay; weak, thick, platy structure; firm; few roots; few pores; bands of reddish-brown (5YR 5/3) silt loam as much as 2 inches thick in the lower part of this horizon; slight effervescence; moderately alkaline.

Thickness of the solum and depth to carbonates are 30 to 40 inches. The Ap horizon is very dark grayish brown, dark brown, or dark grayish brown and is 6 to 9 inches thick. The B2t horizon is silty clay loam, silty clay, or clay and is 20 to 32 inches thick. The C horizon is silty clay loam or silty clay stratified with silt loam or clay or both. In some areas mottling occurs in the lower part of the B horizon and in the C horizon.

Briggsville soils are near Manawa, Sisson, and Tustin soils. Briggsville soils are well drained and moderately well drained, and Manawa soils are somewhat poorly drained. Briggsville soils formed in clayey lacustrine deposits, and Sisson soils formed in loamy deposits that overlie silt loam, and very fine sand lacustrine deposits. Briggsville soils lack the 20- to 40-inch thick sandy mantle of Tustin soils.

BsA—Briggsville silt loam, 0 to 2 percent slopes. This soil is nearly level, and it occupies the low terraces in the old glacial lake basins. The areas are irregular in shape and cover 3 to 60 acres. This

soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Manawa soils, Granby clayey subsoil variant, Tustin soils, and gently sloping Briggsville silt loam. In some areas the surface layer is sandy loam or loamy sand or texture is sandy loam, loam, or clay loam to a depth of 30 inches or the soil is underlain by gravelly sandy loam till.

Runoff is slow. Because the subsoil is clayey, rainwater does not readily enter this soil and, as a result, the surface layer becomes saturated. This soil dries slowly in spring and is likely to be ponded after heavy rains. Because of the small total acreage, it is placed in the capability grouping with soils that formed in similar materials but are subject to erosion.

This soil is suitable for most of the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic matter and good tilth. Capability unit IIe–6; woodland group 2c1; recreation group 3; wildlife group 2; tree and shrub group 1.

BsB—Briggsville silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on low terraces in old glacial lake basins. Areas are irregular in shape and cover 3 to 50 acres.

This soil has a surface layer that is 2 to 3 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Manawa, Granby clayey subsoil variant, and Tustin soils. Also included are small, nearly level areas and eroded areas of Briggsville silt loam. In some places the surface layer is sandy loam or loamy sand or the texture is sandy loam, loam, or clay loam to a depth of 30 inches. Also included are small areas that are underlain by gravelly sandy loam till.

Runoff is medium. The hazard of erosion is moderate. Because the subsoil is clayey, rainwater does not readily enter this soil and the silt loam surface layer is more easily eroded. Where erosion has removed the surface layer and exposed the subsoil, tilth is poor. This soil dries slowly in spring and has water standing in low spots after heavy rains.

This soil is suitable for most of the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic matter and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIe–6; woodland group 2c1; recreation group 3; wildlife group 2, tree and shrub group 1.

Colwood Series

The Colwood series consists of nearly level, poorly drained soils on flood plains and in depressions and old glacial lake basins. These soils are loamy and are underlain by stratified lacustrine deposits of silt loam, silt, fine sand, and very fine sand. The native vegetation was mainly marsh grasses and shrubs and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is black silt loam about 10 inches thick. The subsoil is about 18 inches thick and has yellowish-brown and brownish-yellow mottles. It is light olive-gray, friable loam in the upper part and light-gray, friable silt loam in the lower part. The substratum is light-gray, friable silt loam to a depth of 60 inches and contains coarse silt, fine sand, and very fine sand strata. The substratum has brownish-yellow, strong-brown, brown, and pinkish-gray mottles.

The available water capacity is very high, and permeability is moderate. The depth of root penetration is limited by the water table. Natural fertility is high. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wetland wildlife habitat, and some areas are used for unimproved pasture.

Representative profile of Colwood silt loam, approximately 920 feet north and 1,180 feet east of the southwest corner of NW¼ of sec. 15, T. 16 N., R. 13 E., in a once-cultivated field:

Ap—0 to 10 inches, black (10YR 2/1) silt loam; moderate, medium, granular structure; very friable; few roots; common pores; mildly alkaline; abrupt, smooth boundary.

B21g—10 to 15 inches, light olive-gray (5Y 6/2) loam; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; few roots; few pores; mildly alkaline; clear, smooth boundary.

B22g—15 to 22 inches, light olive-gray (5Y 6/2) heavy loam; many, fine, prominent, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; few roots; few pores; mildly alkaline; gradual, smooth boundary.

IIB23g—22 to 28 inches, light-gray (5Y 6/1) silt loam that has thin strata of fine sand; moderate, medium, prominent, brownish-yellow (10YR 6/6) mottles; weak, fine, subangular blocky structure; friable; slight effervescence; mildly alkaline; clear, smooth boundary.

IIC1g—28 to 38 inches, light-gray (5Y 7/1) silt loam that has thin strata of coarse silt and fine sand; common, medium, prominent, brownish-yellow (10YR 6/6) and strong-brown (7.5YR 5/6) mottles; massive; friable; strong effervescence; mildly alkaline; gradual, smooth boundary.

IIC2g—38 to 60 inches, light-gray (5Y 7/1) silt loam that has thin strata of coarse silt, fine sand, and very fine sand; common, medium, prominent, brown (7.5YR 5/4) and pinkish-gray (7.5YR 7/2) mottles; massive; friable; strong effervescence; mildly alkaline.

The solum is 24 to 50 inches thick and overlies calcareous, stratified silt loam, silt, fine sand, and very fine sand. The A horizon is black, very dark brown, or very dark gray and is 10 to 18 inches thick. The B2 horizon is loam or clay loam 10 to 25 inches thick. The IIB horizon is loam, silt loam, or heavy fine sandy loam 4 to 18 inches thick. It contains strata of coarse silt, fine sand, or very fine sand. The IIC horizon is silt loam, loam, or heavy fine sandy loam. It contains strata of coarse silt, fine sand, or very fine sand and has a few thin strata of silty clay in some places.

Colwood soils are near Barry, Kibbie, and Marshan soils. Colwood soils are underlain by lacustrine deposits of stratified silt loam, silt, fine sand, and very fine sand; Barry soils are underlain by gravelly loamy sand till; Marshan soils are underlain by outwash sand. Colwood soils are poorly drained, and Kibbie soils are somewhat poorly drained.

Co—Colwood silt loam. This soil is nearly level and is on flood plains and in depressions and old glacial lake basins. Most areas are irregular in shape and cover 5 to 80 acres.

Included with this soil in mapping are small areas of Kibbie, Marshan, Palms, and Poy soils and small areas of Colwood silt loam that has slopes of as much as 4 percent. In some areas the surface layer is silty clay loam or sandy loam, or it is muck as much as 16 inches thick, or the substratum is stratified silt and clay.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Precautions must be taken to prevent loose sand from entering the tile lines.

Drained areas of this soil are suitable for some vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Drained areas are used for corn, small grains, and pasture. Some undrained areas are used for unimproved pasture. Capability unit IIw–1; woodland group 1w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Dodge Series

The Dodge series consists of gently sloping and sloping, well-drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 25 inches thick. It is yellowish-brown, friable and firm silt loam and silty clay loam in the upper part and dark yellowish-brown, firm clay loam in the lower part. The substratum is light yellowish-brown, friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage of these soils is used for corn, small grains, legumes, and other crops commonly grown in the county. Some areas of sloping soils are used as woodland or for wildlife habitat.

Representative profile of Dodge silt loam, 2 to 6 percent slopes, approximately 660 feet north and 400 feet east of the southwest corner of the SE¼ of sec. 6, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; few roots; few pores; pockets of yellowish-brown (10YR 5/4) subsoil mixed in by plowing; neutral; abrupt, smooth boundary.

B1t—8 to 13 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak, fine, subangular blocky structure; friable; few roots; few pores; dark grayish-brown (10YR 4/2) soil material in old root and worm channels; light-gray (10YR 7/2), when dry, silt coatings and thin, discontinuous clay films on faces of some peds; medium acid; clear, smooth boundary.

B21t—13 to 22 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium and fine, subangular blocky structure; firm; few roots; few pores; many thin clay films on faces of peds; medium acid; clear, wavy boundary.

B22t—22 to 27 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium and fine, subangular blocky structure; firm; few roots; few pores; many, thin, dark yellowish-brown (10YR 4/4) clay films on faces of peds and in old root channels; medium acid; clear, wavy boundary.

IIB23t—27 to 33 inches, dark yellowish-brown (10YR 4/4) clay loam; weak, medium and fine, subangular blocky structure; firm; few roots; common pores; many thin clay films on faces of peds; thin, discontinuous, very dark grayish-brown (10YR 3/2) clay films on faces of some peds and in old root channels; about 3 percent, by volume, gravel of mixed origin; medium acid; clear, smooth boundary.

IIC—33 to 60 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam; massive; friable; about 20 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 36 percent.

The solum is 28 to 40 inches thick and overlies calcareous, gravelly sandy loam glacial till. The mantle of silty eolian sediment is 26 to 36 inches thick. The Ap horizon is dark grayish brown or brown and is 6 to 9 inches thick. The B1 horizon is heavy silt loam or light silty clay loam 3 to 8 inches thick. The B2t horizon is silty clay loam or heavy silt loam 10 to 25 inches thick. The IIB2t horizon is clay loam or heavy loam 3 to 7 inches thick. Coarse fragments, including cobbles and boulders, in the IIC horizon range from 5 percent to about 25 percent, by volume.

Dodge soils are near Knowles and St. Charles soils. Dodge soils are underlain by gravelly sandy loam till and Knowles soils by dolomite. Dodge soils have a thinner mantle of silty eolian sediment and a thinner solum than St. Charles soils.

DdB—Dodge silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 5 to 80 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of LeRoy soils, and small areas of nearly level or sloping and eroded and severely eroded Dodge silt loam. In some places the mantle of silty eolian sediment is 20 to 26 inches thick, or the subsoil is mottled, or dolomite is at a depth of 40 to 60 inches.

Runoff is medium. The hazard of erosion is slight to moderate.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

DdC2—Dodge silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes of broad ridges on the till plains. Areas are elongated and cover 5 to 40 acres.

This soil has a surface layer that is about 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Knowles soils and of gently sloping or moderately steep Dodge silt loam. Also included are some areas of this soil that are not eroded and some areas that are severely eroded. In some places the mantle of silty eolian sediment is 20 to 26 inches thick. And in places, dolomite is at a depth of 40 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate.

This soil is suitable for all the farm and some of the vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

Edwards Series

The Edwards series consists of nearly level, very poorly drained soils in depressions and old glacial lake basins. These soils are organic and are underlain by marl. The native vegetation was marsh vegetation such as sedges, reeds, and grasses; shrubs such as willow, alder, and dogwood; and trees such as tamarack. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black, nonsticky muck about 30 inches thick. The substratum is white, very friable marl to a depth of 60 inches.

The available water capacity is very high. Permeability is rapid in the organic layer and slow in the substratum. The depth of root penetration is limited by the water table or, in drained areas, by the underlying marl. Natural fertility is low.

Where these soils are drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat, and some are used for unimproved pasture.

Representative profile of Edwards muck, 920 feet north and 550 feet west of the center of sec. 18, T. 14 N., R. 13 E., in a cultivated field:

Oap—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; about 2 percent fiber, a trace rubbed; weak, fine and very fine, crumb structure; nonsticky; mainly herbaceous fibers; neutral; abrupt, smooth boundary.

Oa2—8 to 23 inches, black (N 2/0, broken face and rubbed) sapric material; about 10 percent fiber, a trace rubbed; weak, medium and coarse, crumb structure; nonsticky; mainly herbaceous fibers; neutral; clear, smooth boundary.

Oa3—23 to 30 inches, black (N 2/0, broken face and rubbed) sapric material; about 2 percent fiber, a trace rubbed; weak, thick, platy structure; nonsticky; mainly herbaceous fibers; about 20 percent, by volume, small snail shells and shell fragments; moderately alkaline; clear, smooth boundary.

Lca—30 to 60 inches, white (10YR 8/1) marl; massive; very friable; few thin (less than ⅛ inch) bands of black (N 2/0) sapric material; violent effervescence; moderately alkaline.

The organic layer is 16 to 50 inches thick. Some pedons have thin layers of hemic material that combined to less than 10 inches thick. The organic material is mainly from herbaceous plants but a few woody fragments, ranging from ⅛ inch to several inches in diameter, are mixed throughout the organic part in some places.

Edwards soils are near Houghton soils and have similar drainage to Houghton and Willette soils. Edwards soils have a thinner organic layer than Houghton soils. They are underlain by marl, and Willette soils are underlain by clayey lacustrine deposits.

Ed—Edwards muck. This soil is nearly level and is in depressions and old glacial lake basins. Areas are rounded and cover 5 to 70 acres.

Included with this soil in mapping are small areas of Houghton, Palms, and Ossian soils. Also included are some areas where the organic layer is less than 16 inches thick and small areas that have as much as 16 inches of loamy overwash.

Runoff is very slow. This soil is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. The tile should be placed in the organic material because the marl is slowly permeable. Cultivated areas are subject to soil blowing and burning. Where the water table is lowered excessively in cultivated areas, the organic matter decomposes very rapidly and subsidence becomes a problem.

Where this soil is drained, it is suitable for certain vegetable crops such as beets, carrots, and lettuce. Undrained areas are suitable for wetland wildlife habitat. Drained areas are used for corn and mint. Capability unit IVw–7; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

Friesland Series

The Friesland series consists of nearly level and gently sloping, well drained and moderately well drained soils on till plains. These soils are loamy and are underlain by silt loam eolian deposits or gravelly sandy loam glacial till. The native vegetation was prairie grasses. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is about 13 inches thick. It is very dark gray loam in the upper part and very dark grayish-brown loam in the lower part. The subsoil is about 53 inches thick. It is dark-brown, friable loam in the upper part; dark yellowish-brown, friable fine sandy loam in the middle part; and dark yellowish-brown, and yellowish-brown, friable silt loam in the lower part. The substratum is brown, friable silt loam to a depth of 74 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. Canning crops such as peas such as peas and sweet corn are also grown.

Representative profile of Friesland loam, 2 to 6 percent slopes, approximately 600 feet north and 35 feet east of the southwest corner of NW¼, sec. 19, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, very dark gray (10YR 3/1) loam; weak, coarse, subangular blocky structure; very friable; few roots; few pores; medium acid; abrupt, smooth boundary.

A12—7 to 13 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, platy structure; very friable; few roots; common pores; few earthworm casts; medium acid; clear, smooth boundary.

B1—13 to 21 inches, dark-brown (10YR 3/3) loam; weak, fine, subangular blocky structure; friable; few roots; common pores; medium acid; clear, smooth boundary.

B21t—21 to 38 inches, dark yellowish-brown (10YR 4/4) heavy fine sandy loam; weak, medium, subangular blocky structure; friable; few roots; common pores; few thin clay films on faces of peds; medium acid; abrupt, smooth boundary.

IIB22t—38 to 45 inches, dark yellowish-brown (10YR 4/4)

heavy silt loam; weak, fine, prismatic structure parting to weak, fine, subangular blocky; friable; few roots; common pores; common thin clay films on faces of peds; medium acid; gradual, wavy boundary.

IIB223t—45 to 66 inches, yellowish-brown (10YR 5/4) silt loam; few, fine, distinct yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure; friable; many pores; few thin clay films on faces of peds; medium acid; gradual, wavy boundary.

IIC—66 to 74 inches, brown (10YR 5/3) silt loam; massive; friable; slight effervescence; moderately alkaline.

The solum is 40 to 72 inches thick and in some places extends into the underlying till. The soil is dark colored to a depth of 10 to 22 inches. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 18 inches thick. The B1 horizon is loam or heavy fine sandy loam 5 to 10 inches thick. The B2t horizon is loam or heavy fine sandy loam 12 to 18 inches thick. Gravel in the underlying till ranges from about 5 to 25 percent, by volume. In some places mottles are in the middle and lower parts of the B horizon and in the C horizon.

Friesland soils are near Griswold and Plano soils. They have a thicker solum and more silt in the B horizon than Griswold soils. They have more sand in the A horizon and upper part of the B horizon than Plano soils.

FoA—Friesland loam, 0 to 2 percent slopes. This soil is nearly level and is on the broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 5 to 130 acres.

Included with this soil in mapping are small areas of gently sloping Friesland loam. Also included are some small areas where the surface layer is loamy fine sand or fine sandy loam.

Runoff is slow.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil has few limitations and can be cropped intensively where management includes regular additions of organic matter and maintains tilth. Capability unit I–4; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

FoB—Friesland loam, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors on till plains. Areas are irregular in shape and cover 5 to 180 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of nearly level Friesland loam and areas where slopes are as steep as 11 percent. Also included are some small areas where the surface layer is loamy fine sand or fine sandy loam.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. Where erosion is controlled, this soil has few limitations and can be cropped intensively. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

Gotham Series

The Gotham series consists of nearly level to moderately steep, well drained to somewhat excessively drained soils that occupy outwash plains, terraces, old glacial lake basins and the adjacent uplands that have been mantled by eolian sand. These soils are sandy and are underlain by sand or weakly cemented sandstone. The native vegetation was mixed prairie grasses and hardwood forest, or in some areas, pine trees.

In a representative profile the surface layer is dark-brown loamy fine sand about 8 inches thick. The subsoil is about 26 inches thick. It is brown, very friable loamy fine sand in the upper part; strong-brown, very friable loamy fine sand in the middle part; and strong-brown, loose medium sand in the lower part. The substratum is strong-brown and yellowish-brown, loose medium sand to a depth of 60 inches.

The available water capacity is low and permeability is rapid. Natural fertility is low. The organic-matter content of the surface layer is low.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. Some areas are in woodland or wildlife habitat. Some areas of these soils that were farmed in the past are no longer actively farmed.

Representative profile of Gotham loamy fine sand, 1 to 6 percent slopes, approximately 1,200 feet south and 1,200 feet east of the northwest corner of sec. 6, T. 15 N., R. 12 E., in a cultivated field:

Ap—0 to 8 inches, dark-brown (10YR 3/3) loamy fine sand; weak, fine, granular structure; very friable; few roots; common pores; neutral; abrupt, smooth boundary.

B21t—8 to 23 inches, dark-brown (7.5YR 4/4) loamy fine sand; weak, medium, subangular blocky structure; very friable; few roots; common pores; clay bridging between sand grains; neutral; clear, smooth boundary.

B22t—23 to 29 inches, strong-brown (7.5YR 5/6) loamy fine sand; very weak, fine, subangular blocky structure; very friable; few roots; few pores; clay bridging between sand grains; neutral; clear, smooth boundary.

B3—29 to 34 inches, strong-brown (7.5YR 5/6) medium sand; very weak, fine, subangular blocky structure, single grained where disturbed; loose; few roots; neutral; clear, smooth boundary.

C1—34 to 39 inches, strong-brown (7.5YR 5/6) medium sand; single grained; loose; few roots; neutral; clear, smooth boundary.

C2—39 to 60 inches, yellowish-brown (10YR 5/4) medium sand; single grained; loose; neutral; gradual, smooth boundary.

The solum is 24 to 40 inches thick and overlies sand. The Ap horizon is very dark gray, very dark grayish brown, or dark brown and is 6 to 9 inches thick. The B2t horizon is loamy sand or loamy fine sand 9 to 24 inches thick.

Gotham soils are near Brems, Oakville, and Richford soils. Gotham soils have a layer of clay accumulation in the B horizon which Brems and Oakville soils lack. Gotham soils are well drained and somewhat excessively drained, and Brems soils are moderately well drained. Gotham soils lack the sandy loam layer that is in the B horizon of Richford soils.

GaB—Gotham loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on sandy outwash plains and terraces and in old glacial lake basins. It is also on the adjacent uplands that have been deeply mantled by eolian sand. Most areas are elongated and cover 3 to 75 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Boyer, Oshtemo, and Richford soils and small areas of sloping and eroded Gotham loamy fine sand. In some places the surface layer is fine sand. Also included are areas of this soil that are underlain by loamy layers, stratified sand and gravel, or gravelly sandy loam till

below a depth of 50 to 60 inches or that are underlain by sandstone bedrock below a depth of 30 inches.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Early spring plantings, before the soil has a chance to dry, are best on this soil. Later plantings, especially of small seeded crops, have a poor chance of survival.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and to certain vegetable crops. Most of the acreage is used for general farm crops and some is in native woodland. Some areas have been planted to pine trees. Fertilization, supplemental irrigation, and protection from soil blowing are necessary for dependable crop production. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVs–3; woodland group 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

GaC—Gotham loamy fine sand, 6 to 12 percent slopes. This soil is sloping and is on sandy outwash plains, terraces, and the adjacent uplands that have been deeply mantled by eolian sand. Areas are elongated and cover 3 to 60 acres.

This soil has a surface layer and subsoil which, combined, are about 6 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Boyer and Richford soils and of gently sloping and eroded Gotham loamy fine sand. Also included are some areas that have a surface layer of fine sand or that are underlain by loamy layers, stratified sand and gravel, or gravelly sandy loam till below a depth of 50 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons.

Where this soil is managed properly, it is suited to growing most farm crops. Most of the acreage is used for general farm crops and some is in native woodland. Some areas have been planted to pine trees. Planting early in spring before the soil has a chance to dry is best. Later plantings, especially of small seeded crops, have a poor chance of survival. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVs–3; woodland group 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

GbC—Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes. This soil is sloping and is on hillsides where it is relatively thin over weakly cemented sandstone bedrock. Most areas are elongated and cover 3 to 50 acres.

This soil has a profile similar to the one described as representative of the series, but it is underlain by sandstone bedrock at a depth of 20 to 38 inches.

Included with this soil in mapping are small areas of Boyer and Urne soils. Also included are small areas of gently sloping or moderately steep and eroded Gotham loamy fine sand, sandstone substratum. In some areas depth to sandstone bedrock is more than 39 inches or less than 20 inches. In some places the surface layer is fine sand.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Early spring plantings, before the soil has a chance to dry, are best. Later plantings, especially of small seeded crops, have a poor chance of survival.

Most of the acreage is used for woodland. Some areas are used for crops and pasture. The main concerns of management are regularly supplying organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVs–3; woodland group 3s1; recreation group 4; wildlife group 3; tree and shrub group 2.

GbD—Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes. This soil is moderately steep and is on hillsides where it is relatively thin over weakly cemented sandstone bedrock. Most areas are elongated and cover 3 to 20 acres.

This soil has a profile similar to the one described as representative of the series, but it is underlain by sandstone bedrock at a depth of 20 to 38 inches.

Included with this soil in mapping are small areas of Boyer, Oakville, and Urne soils. Also included are small sloping areas; areas that have slopes as steep as 30 percent; eroded areas; and some areas where the surface layer is fine sand. Also included are some small areas where depth to sandstone bedrock is more than 39 inches or less than 20 inches.

Runoff is medium, and the hazard of erosion is severe. This soil is subject to soil blowing. It has a low available water capacity.

This soil is generally not suited to cultivated crops. It is better suited to woodland or wildlife habitat. Most of the acreage is in woodland and some has been planted to pine trees. The main concerns of management are maintaining plant cover and controlling erosion and soil blowing. Capability unit VIe–7; woodland group 3s3; recreation group 4; wildlife group 3; tree and shrub group 2.

Granby Series

The Granby series consists of nearly level, poorly drained soils on flood plains and in depressions and old glacial lake basins. These soils are sandy and are underlain by sand. The native vegetation was mainly marsh grasses and shrubs and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is black and very dark gray loamy fine sand about 11 inches thick. The lower part of the surface layer has dark grayish-brown mottles. The subsoil is about 24 inches thick and has light brownish-gray, brown, yellowish-brown, brownish-yellow, and dark-red mottles. It is dark grayish-brown and light brownish-gray, loose fine sand in the upper part and yellowish-brown, loose fine sand in the lower part. The substratum is light yellowish-brown, loose fine sand to a depth of 60 inches.

The available water capacity is low, and permeability is rapid. The depth of root penetration is limited by the water table or, in drained areas, by the underlying

sand. Natural fertility is low. The organic-matter content of the surface layer is moderately low.

Where drained, most of the acreage is used for corn, small grains, and hay. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Granby loamy fine sand, approximately 60 feet east and 660 feet north of the center of sec. 13, T. 15 N., R. 11 E., in a formerly cultivated field:

Ap—0 to 8 inches, black (10YR 2/1) loamy fine sand; weak, fine, granular structure, single grained where disturbed; very friable; few roots; neutral; abrupt, smooth boundary.

A12—8 to 11 inches, very dark gray (10YR 3/1) loamy fine sand; common, medium, distinct, dark grayish-brown (2.5Y 4/2) mottles; weak, coarse, subangular blocky structure, single grained where disturbed; very friable; few roots; slightly acid; abrupt, smooth boundary.

B2g—11 to 14 inches, mixed dark grayish-brown (2.5Y 4/2) and light brownish-gray (2.5Y 6/2) fine sand; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; very weak, coarse, subangular blocky structure, single grained where disturbed; loose; few roots; some very dark gray (10YR 3/1) soil material in old root channels; slightly acid; clear, smooth boundary.

B31—14 to 21 inches, yellowish-brown (10YR 5/4) fine sand; common, fine, distinct, brownish-yellow (10YR 6/6) and light brownish-gray (2.5Y 6/2) mottles and few, fine faint, brown (7.5YR 4/4) mottles; very weak, coarse, subangular blocky structure, single grained where disturbed; loose; few roots; slightly acid; gradual, wavy boundary.

B32—21 to 35 inches, yellowish-brown (10YR 5/6) fine sand; few, medium, prominent, dark-red (2.5YR 3/6) mottles; very weak, coarse, subangular blocky structure, single grained where disturbed; loose; few roots; slightly acid; gradual, wavy boundary.

C—35 to 60 inches, light yellowish-brown (10YR 6/4) fine sand; single grained; loose; neutral.

The solum is 22 to 40 inches thick. The soil is dark colored to a depth of 10 to 16 inches. The A horizon is black, very dark brown, or very dark gray and is 10 to 16 inches thick. The B2g horizon is loamy fine sand or fine sand 3 to 12 inches thick.

Granby soils are near Adrian, Brems, and Granby loamy subsoil variant soils. Granby soils lack the 16- to 50-inch organic layer of Adrian soils. Granby soils are poorly drained and Brems soils are moderately well drained. Granby soils are coarser textured in the lower part of the B horizon and in the C horizon than Granby, loamy subsoil variant soils.

Gf—Granby loamy fine sand. This soil is nearly level and is on flood plains and in depressions and old glacial lake basins. Areas are irregular in shape and cover 5 to 1,400 acres.

Included with this soil in mapping are small areas of Adrian, Brems, Colwood, Granby loamy subsoil variant, Marshan, and Poy soils. In some small areas this soil has an organic surface layer as much as 16 inches thick. Also included are some areas that have thin bands of loam, silty clay loam, clay loam, sandy loam, or sandy clay loam in the subsoil and in the substratum.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drains are used to remove excess surface water rapidly. Deep ditches are used for internal drainage. Where this soil is drained, it is subject to soil blowing. Where the water table is lowered excessively, this soil loses the beneficial effects of free water in the lower part.

Where this soil is properly managed, it is suitable for certain vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Some undrained areas are used for unimproved pasture. Where drained, this soil is used for corn, small grains, and hay. Capability unit IVw–5; woodland group 3w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Granby, Loamy Subsoil Variant

The Granby loamy subsoil variant consists of nearly level and gently sloping, poorly drained soils on flood plains and in depressions and old glacial lake basins. These soils are sandy and are underlain by loamy soil. The native vegetation was mainly marsh grasses and shrubs and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is very dark grayish-brown loamy fine sand about 11 inches thick. The lower part of the surface layer has light yellowish-brown mottles. The subsoil is about 26 inches thick, and has yellowish-brown mottles. It is pale-brown, light-gray, and light brownish-gray, very friable fine sand in the upper part and light-gray, friable loam in the lower part. The substratum is yellowish-brown, friable sandy loam to a depth of 60 inches. It has light-gray mottles.

The available water capacity is moderate. Permeability is rapid in the upper part of the subsoil and moderate in the lower part of the subsoil and in the substratum. Depth of root penetration is limited by the water table. Natural fertility is low. The organic-matter content of the surface layer is moderately low.

Undrained areas are suitable for wetland wildlife habitat. Where drained, most of the acreage is used for corn, small grains, and hay. Some undrained areas are used for unimproved pasture.

Representative profile of Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes, approximately 400 feet south and 860 feet east of the northwest corner of the NE¼ of sec. 35., T. 16 N., R. 12 E., in a cultivated field:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, fine and medium, subangular blocky structure; very friable; few roots; slightly acid; abrupt, smooth boundary.

A12—8 to 11 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; common, medium, prominent, light yellowish-brown (2.5Y 6/4) mottles; weak, fine and medium, subangular blocky structure; very friable; few roots; neutral; abrupt, smooth boundary.

B21—11 to 23 inches, mixed light-gray (10YR 7/2) and pale-brown (10YR 6/3) fine sand; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; very weak, coarse, subangular blocky structure; very friable; matrix color is caused by uncoated sand grains; neutral; gradual, wavy boundary.

B22g—23 to 30 inches, light brownish-gray (10YR 6/2) fine sand; few, fine, prominent, yellowish-brown (10YR 5/6) mottles; very weak, coarse, subangular blocky structure; very friable; neutral; abrupt, smooth boundary.

IIB23g—30 to 37 inches, light-gray (10YR 7/2) loam; many, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; friable; neutral; clear, wavy boundary.

IIC—37 to 60 inches, yellowish-brown (10YR 5/6) sandy

loam; many, medium, prominent, light-gray (10YR 7/2) mottles; massive; friable; neutral.

The solum is 30 to 50 inches thick. The depth to the loamy IIB horizon is 24 to 39 inches. The soil is dark colored to a depth of 10 to 16 inches. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 16 inches thick. The B2 horizon is loamy fine sand or fine sand 14 to 22 inches thick. The IIB2 and IIC horizons are loam, sandy loam, sandy clay loam, or clay loam. The IIB2 horizon is 6 to 18 inches thick.

Granby loamy subsoil variant soils are near Colwood and Granby soils. They are underlain by loam, sandy loam, sandy clay loam, or clay loam, and Colwood soils are underlain by stratified silt loam, silt, fine sand, and very fine sand. They are finer textured in the lower part of the B horizon and in the C horizon than Granby soils.

GhA—Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is on flood plains and in depressions and old glacial lake basins. Areas are irregular in shape and cover 3 to 150 acres.

Included with this soil in mapping are small areas of Adrian, Brems, Granby, and Palms soils. Also included are areas of Granby loamy fine sand, loamy subsoil variant soils that are saturated with water below a depth of 1 to 3 feet during wet periods and are somewhat poorly drained. In some small areas the sandy upper layer is more than 40 inches thick, or the surface layer is organic and as much as 16 inches thick, or the surface layer is fine sand or sand, or the entire subsoil is sandy loam.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Where drained, it is subject to soil blowing. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Unless tiles are placed in the loamy parts of the soil, loose sand enters the tile lines.

Where this soil is properly managed, it is suitable for certain vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn, small grains, and hay. Some undrained areas are used for unimproved pasture. Capability unit IIIw–6; woodland group 3w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Granby, Clayey Subsoil Variant

The Granby clayey subsoil variant consists of nearly level and gently sloping, poorly drained soils on flood plains and in depressions and old glacial lake basins. These soils are sandy and are underlain by clayey lacustrine soil. The native vegetation was mainly marsh grasses and shrubs and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is black loamy fine sand about 12 inches thick. The subsoil is about 26 inches thick. It is light gray, very friable fine sand in the upper part and mixed gray and reddish-brown, firm silty clay in the lower part. The substratum is reddish-brown, firm silty clay to a depth of 60 inches and has reddish-yellow mottles.

The available water capacity is moderate. Permeability is rapid in the upper part of the subsoil and slow in the lower part of the subsoil and in the substratum. Depth of root penetration is limited by the water table. Natural fertility is low. The organic-matter content of the surface layer is moderately low.

Where drained, most of the acreage is used for corn, small grains, and hay. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes, approximately 150 feet east and 50 feet south of the northwest corner of the NE¼ of sec. 5, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, black (10YR 2/1) loamy fine sand; weak, fine, granular structure; very friable; common roots; common pores; mildly alkaline; abrupt, smooth boundary.

A12—7 to 12 inches, black (10YR 2/1) loamy fine sand; weak, fine, crumb structure; very friable; common roots; common pores; mildly alkaline; clear, smooth boundary.

B1g—12 to 33 inches, light-gray (2.5Y 7/2) fine sand; weak, medium and coarse, subangular blocky structure; very friable; few roots; common pores; mildly alkaline; clear, smooth boundary.

IIB2—33 to 38 inches, mixed gray (5Y 5/1) and reddish-brown (5YR 4/4) silty clay; moderate, medium, angular blocky structure; firm; common pores; light-gray (2.5Y 7/2) fine sand from the B1g horizon coating the faces of some peds; neutral; gradual, irregular boundary.

IIC—38 to 60 inches, reddish-brown (15YR 4/4) silty clay; common, fine, distinct, reddish-yellow (5YR 6/6) mottles; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; firm; few pores; neutral.

The solum is 30 to 50 inches thick. The depth to the clayey IIB horizon is 25 to 39 inches. The soil is dark colored to a depth of 10 to 16 inches. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 16 inches thick. The B1 horizon is loamy sand, loamy fine sand, sand, or fine sand 12 to 28 inches thick. The IIB horizon is clay or silty clay 3 to 10 inches thick. The IIC horizon is clay or silty clay, and in some places it contains thin strata of silt loam and silty clay loam.

Granby clayey subsoil variant soils are near Granby and Willette soils. Granby clayey subsoil variant soils are underlain by clay or silty clay, and Granby soils are sandy throughout. Granby clayey subsoil variant soils lack the 16- to 50-inch organic layer of Willette soils.

GkA—Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes. This soil is nearly level and is on flood plains and in depressions and old glacial lake basins. Areas are irregular in shape and cover 3 to 65 acres.

Included with this soil in mapping are small areas of Adrian, Brems, Granby, and Granby loamy subsoil variant soils. In some places there is an organic surface layer as much as 16 inches thick, or the surface layer is fine sand or sand, or this soil has as much as 20 inches of loamy overwash.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Where drained, it is subject to soil blowing. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Care must be taken to prevent loose sand from entering tile lines placed in the upper sandy part of the soil.

Where this soil is properly managed, it is suitable

for certain vegetable crops. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn, small grains, and hay. Some undrained areas are used for unimproved pasture. Capability unit IIIw–6; woodland group 3w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Grellton Series

The Grellton series consists of nearly level to moderately steep, well drained and moderately well drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 6 inches thick. The subsoil is about 50 inches thick. It is yellowish-brown, and brown, friable and firm loam in the upper part; yellowish-brown, friable silt loam in the middle part; and brown, friable sandy clay loam in the lower part. The substratum is brown, very friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. Organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Grellton fine sandy loam, 2 to 6 percent slopes, approximately 1,200 feet south and 800 feet west of the northeast corner of sec. 22, T. 16 N., R. 13 E., in a cultivated field:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; very friable; few fine roots; few pores; some yellowish-brown (10YR 5/4) subsoil material mixed in by plowing; slightly acid; abrupt, smooth boundary.

B1t—6 to 11 inches, yellowish-brown (10YR 5/4) light loam; weak, fine, subangular blocky structure; friable; few fine roots; few pores; thin discontinuous clay films on faces of a few peds and in pores and channels; very pale brown (10YR 8/3), when dry, silt coatings on faces of many peds; medium acid; clear, smooth boundary.

B21t—11 to 25 inches, brown (7.5YR 4/4) heavy loam; moderate, fine and medium, subangular blocky structure; firm; few fine roots; few pores; thin discontinuous clay films on faces of some peds and in pores and channels; medium acid; gradual, wavy boundary.

B22t—25 to 31 inches, brown (10YR 4/3) light loam; moderate, fine and very fine, subangular blocky structure; friable; few pores; thin discontinuous clay films on faces of most peds and in pores and channels and thin discontinuous black (10YR 2/1) clay films on faces of some peds; slightly acid; clear, wavy boundary.

IIB23t—31 to 47 inches, yellowish-brown (10YR 5/4) silt loam; weak, medium, prismatic structure parting to weak, fine and medium, subangular blocky; friable; common pores; thin discontinuous brown (7.5YR 4/4) clay film on faces of peds and in pores and channels; slightly acid; clear, smooth boundary.

IIIB3t—47 to 56 inches, brown (7.5YR 4/4) sandy clay loam; weak, medium, subangular blocky structure; friable; few pores; thin discontinuous clay films on faces of some peds; neutral; gradual, wavy boundary.

IIIC—56 to 60 inches, brown (7.5YR 4/4) gravelly sandy loam; massive; very friable; about 20 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 29 percent.

The solum is 42 to 72 inches thick and overlies calcareous, gravelly sandy loam glacial till. In some places, the solum does not extend into the underlying till. In these places, the IIIC horizon is brown, yellowish-brown, or light yellowish-brown silt loam. The Ap horizon is dark grayish brown or very dark grayish brown and is 5 to 8 inches thick. The B1t horizon is loam or sandy loam 4 to 8 inches thick. The B2t horizon is loam, clay loam, sandy clay loam, or heavy sandy loam 12 to 36 inches thick. Gravel in the IIIC horizon ranges from 5 to 25 percent, by volume. Some areas of these soils are mottled in the middle and lower parts of the B horizon and in the C horizon.

Grellton soils are near Kidder, Okee, and Rotamer soils. They have a thicker solum than Kidder and Rotamer soils and have a silt loam IIB horizon which Kidder and Rotamer soils lack. They lack the 20- to 40-inch sand or loamy sand characteristic of the upper part of the solum of Okee soils.

GnA—Grellton fine sandy loam, 0 to 2 percent slopes. This soil is nearly level and is on the broad ridgetops and valley floors of till plains. Most areas are irregular in shape and cover 5 to 30 acres.

This soil has a surface layer that is about 3 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Okee soils; small areas of gently sloping Grellton fine sandy loam; and areas where the surface layer is silt loam, loam, loamy fine sand, or fine sand. Also included are areas where this soil is underlain by stratified sand and gravel.

Runoff is slow. During dry periods the soil is subject to soil blowing.

This soil is suitable for all the farm and vegetable crops grown in the county. It has few limitations and can be cropped intensively where organic-matter content and tilth are maintained. Most of the acreage is used for crops. Capability unit I–4; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

GnB—Grellton fine sandy loam, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to 120 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Okee soils and nearly level or sloping and eroded Grellton fine sandy loam. In some places the surface layer is silt loam, loam, loamy fine sand, or fine sand. Also included are areas where this soil is underlain by stratified sand and gravel.

Runoff is medium. The hazard of erosion is slight. During dry periods this soil is subject to soil blowing.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, reducing runoff, improving tilth, and controlling erosion and soil blowing. Capability unit IIe–1; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

GnC2—Grellton fine sandy loam, 6 to 12 percent

slopes, eroded. This soil is sloping and is on the side slopes adjacent to drainageways of till plains. Most areas are elongated and cover 3 to 30 acres.

This soil has a surface layer that is about 4 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Okee and Rotamer soils and small areas of gently sloping or moderately steep and uneroded and severely eroded Grellton fine sandy loam. In some areas the surface layer is silt loam, loam, loamy fine sand, or fine sand. Also included are areas where this soil is underlain by stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate. During dry periods, this soil is subject to soil blowing.

With proper management, this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, reducing runoff, improving tilth, and controlling erosion and soil blowing. Capability unit IIIe–1; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

GnD2—Grellton fine sandy loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on the side slopes adjacent to drainageways of the till plains. Areas are elongated and cover 3 to 20 acres.

This soil has a profile similar to the one that is described as representative of the series, but the surface layer and subsoil combined are about 8 inches thinner.

Included with this soil in mapping are small areas of Okee and Rotamer soils and small areas of sloping and uneroded and severely eroded Grellton fine sandy loam. In some small areas this soil has slopes of as much as 30 percent; or the surface layer is silt loam, loam, loamy fine sand, or fine sand; or the soil is underlain by stratified sand and gravel or stratified silt and fine sand.

Runoff is rapid, and the hazard of erosion is severe.

This soil is best suited to close-growing crops, pasture, or woodland. Most of the acreage is used for crops and pasture and some is used for woodland. The main concerns of management are maintaining organic-matter content, reducing runoff, and controlling erosion. Capability unit IVe–1; woodland group 1r1; recreation group 1; wildlife group 1; tree and shrub group 1.

Griswold Series

The Griswold series consists of nearly level to sloping, well-drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was prairie grasses.

In a representative profile the surface layer is about 12 inches thick. It is very dark brown silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 20 inches thick. It is brown, firm clay loam in the upper part and dark yellowish-brown, friable sandy loam in the lower part. The substratum is yellowish-brown, very friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Griswold silt loam, 2 to 6 percent slopes, 1,260 feet east and 330 feet south of the center of sec. 2., T. 16 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; weak, fine, granular structure; very friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil from the A3 horizon mixed in by plowing; mildly alkaline; abrupt, smooth boundary.

A3—8 to 12 inches; very dark grayish-brown (10YR 3/2) silt loam; weak, medium, subangular blocky structure; friable; common roots; common pores; some very dark brown (10YR 2/2) soil material in worm and root channels; neutral; abrupt, smooth boundary.

B21t—12 to 24 inches, brown (10YR 4/3) light clay loam; moderate, very fine, subangular blocky structure; firm; common roots; common pores; many thin clay films on faces of peds and in pores and channels; medium acid; gradual, wavy boundary.

B22t—24 to 32 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; few roots; common pores; few thin clay films on faces of peds and on pebbles and in pores and channels; about 5 percent gravel, by volume; slightly acid; gradual, wavy boundary.

C—32 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; very friable; few roots; about 20 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent to 21 percent.

The solum is 24 to 40 inches thick and overlies calcareous, gravelly sandy loam glacial till. The soil is dark colored to a depth of 10 to 16 inches. The A horizon is very dark gray, very dark grayish brown, very dark brown, or dark brown and is 10 to 14 inches thick. The B2t horizon is heavy loam, clay loam, heavy sandy loam, or sandy clay loam 12 to 28 inches thick. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 25 percent, by volume.

Griswold soils are near Friesland, Marcellon, and Rotamer soils. They have a thinner solum than Friesland soils and lack the silt loam IIB horizon of those soils. Griswold soils are well drained, and Marcellon soils are somewhat poorly drained. Griswold soils have a thicker solum than Rotamer soils.

GrA—Griswold silt loam, 0 to 2 percent slopes. This soil is nearly level and is on the valley floors and broad ridgetops of till plains. Areas are irregular in shape and cover 3 to 70 acres.

This soil has a surface layer that is about 2 to 4 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of gently sloping Griswold silt loam. In some places the surface layer is fine sandy loam. Also included are areas where the coarse fragments in the till are mostly angular dolomite or where dolomite bedrock is at a depth of 45 to 60 inches.

Runoff is slow.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The soil has few limitations and can be cultivated intensively if management includes regular additions of organic matter and maintains tilth.

Capability unit I–4; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

GrB—Griswold silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on the valley floors and broad ridgetops of till plains. Areas are irregular in shape and cover 3 to 180 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Rotamer soils and small areas of nearly level or sloping and eroded Griswold silt loam. In some places the surface layer is fine sandy loam, or the coarse fragments in the underlying till are mostly angular dolomite, or the substratum is sand or stratified sand and gravel, or dolomite is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content and good tilth, reducing runoff, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

GrC2—Griswold silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on the side slopes of till plains. Areas are elongated and cover 3 to 40 acres.

This soil has a surface layer that is about 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Rotamer soils and small areas of gently sloping and uneroded and severely eroded Griswold silt loam. In some places the surface layer is fine sandy loam, or the coarse fragments in the till are mostly angular dolomite, or the dolomite bedrock is at a depth of 45 to 60 inches. In some small areas the substratum is sand or stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate.

With proper management, this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content and good tilth, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

Houghton Series

The Houghton series consists of nearly level, very poorly drained soils on flood plains and in drainageways, depressions, and old glacial lake basins. These soils are organic and are underlain by mineral soil material at a depth greater than 51 inches. The native vegetation was marsh type such as sedges, reeds, and grasses; shrubs such as willow, alder, aspen, and dogwood; and trees such as tamarack. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black nonsticky muck to a depth of 60 inches. The content of plant fibers increases in the lower part of the organic layer.

The available water capacity is very high, and permeability is rapid in the organic layers. Depth of root penetration is limited by the water table. Natural fertility is low.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat and some are used for unimproved pasture.

Representative profile of Houghton muck, approximately 200 feet west and 660 feet north of the southeast corner of the NE¼ of sec. 8, T. 15 N., R. 12 E., in a cultivated field:

Oap—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; less than 5 percent fiber, a trace rubbed; weak, fine, granular structure; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; slightly acid; abrupt, smooth boundary.

Oa2—8 to 14 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; weak, fine, granular structure; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; neutral; clear, smooth boundary.

Oa3—14 to 30 inches, black (N 2/0, broken face and rubbed) sapric material; about 15 percent fiber, 5 percent rubbed; massive; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; neutral; gradual, smooth boundary.

Oa4—30 to 40 inches, black (N 2/0, broken face and rubbed) sapric material; about 10 percent fiber, less than 5 percent rubbed; massive; nonsticky; mainly herbaceous fibers; a few woody fragments; some uncoated quartz grains; slightly acid; clear, smooth boundary.

Oa5—40 to 45 inches, black (N 2/0, broken face and rubbed) sapric material; about 30 percent fiber, 5 percent rubbed; weak, thin, platy structure; nonsticky; mainly herbaceous fibers; a few woody fragments; some uncoated quartz grains; neutral; clear, smooth boundary.

Oa6—45 to 60 inches, black (N 2/0, broken face and rubbed) sapric material; about 15 percent fiber, a trace rubbed; massive; nonsticky; mainly herbaceous fibers; some uncoated quartz grains; neutral; clear, smooth boundary.

The organic layer is more than 51 inches thick. The subsurface tier and the organic part of the bottom tier are black, very dark brown, or very dark grayish brown dominantly sapric material, but some pedons have thin layers of hemic material or fibric material or both. The organic materials come mainly from herbaceous plants, but a few woody fragments ranging from ⅛ inch to several inches in diameter are mixed throughout the organic layer in some places. The C horizon is sandy, loamy, clayey, or is marl. In many places it is mottled.

Houghton soils are near Adrian and Palms soils. They have a thicker organic layer than Adrian and Palms soils.

Ho—Houghton muck. This soil is nearly level and is on flood plains and in drainageways, depressions, and old glacial lake basins. Areas are elongated to irregular in shape and cover 5 to 400 acres.

Included with this soil in mapping are small areas of Adrian, Edwards, and Palms soils. Also included are some small areas that have slopes of as much as 4 percent, or have as much as 16 inches of sandy or loamy overwash, or have thin sandy, loamy, or clayey mineral layers in the organic layer. Also included are areas along the shores of lakes and rivers in which the organic layer is floating on water.

Runoff is very slow. This soil is likely to be ponded during wet seasons and after heavy rains. Cultivated areas are subject to soil blowing and burning. Where the water table is lowered excessively, the organic matter decomposes very rapidly and subsidence becomes a

problem. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Drained areas of this soil are suitable for certain vegetable crops such as beets, carrots, and lettuce. Undrained areas are suitable for wetland wildlife habitat. Where drained, this soil is used for corn. Capability unit IIIw–9; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

Joy Series

The Joy series consists of nearly level and gently sloping, somewhat poorly drained soils on low terraces adjacent to flood plains and in drainageways and depressions. These soils are loamy and are underlain by calcareous silt loam. The native vegetation was mainly prairie grasses. Unless these soils are drained, they are saturated with water below a depth of 1 to 3 feet during wet periods.

In a representative profile the surface layer is very dark gray silt loam about 11 inches thick. The subsoil is about 54 inches thick and has yellowish-brown strong-brown, grayish-brown, and reddish-brown mottles. It is light olive brown, friable silt loam in the upper part; mixed, yellowish-brown and light brownish-gray, friable silt loam in the middle part; and light brownish-gray, friable silt loam in the lower part. The substratum is light olive gray, very friable silt loam to a depth of 76 inches, and has strong-brown and reddish-brown mottles.

The available water capacity is very high, and permeability is moderate. The depth of root penetration is limited by saturated soil during wet periods. Natural fertility is high. The organic-matter content of the surface layer is high.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wildlife habitat and some are used for unimproved pasture.

Representative profile of Joy silt loam, 0 to 3 percent slopes, approximately 210 feet east and 55 feet south of the northwest corner of the SW¼ of sec. 23, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; weak, very fine, granular structure; very friable; few roots; common pores; neutral; abrupt, smooth boundary.

A12—8 to 11 inches, very dark gray (10YR 3/1) silt loam; weak, very fine, granular structure; very friable; few roots; few pores; some light olive-brown (2.5Y 5/4) worm casts; neutral; clear, smooth boundary.

B21—11 to 14 inches, light olive-brown (2.5Y 5/4) silt loam; few, fine, faint, grayish-brown (2.5Y 5/2) mottles and common, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, prismatic structure parting to moderate, very fine, subangular blocky; friable; few roots; common pores; very dark gray (10YR 3/1) soil material from the A12 horizon in worm and root channels and coating the faces of many peds; neutral; clear, smooth boundary.

B22—14 to 26 inches, light olive-brown (2.5Y 5/4) silt loam; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, very fine, subangular blocky structure; friable; few roots; common pores; strongly acid; gradual, wavy boundary.

B23—26 to 41 inches, mixed yellowish-brown (10YR 5/6) and light brownish-gray (2.5Y 6/2) silt loam; moderate, medium, prismatic structure; friable; common pores; very pale brown (10YR 8/3), when dry, silt coatings on faces of some peds; strongly acid; gradual, wavy boundary.

B24—41 to 57 inches, mixed yellowish-brown (10YR 5/6) and light brownish-gray (2.5Y 6/2) heavy silt loam; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; friable; common pores; strongly acid; gradual, wavy boundary.

B3—57 to 65 inches, light brownish-gray (2.5Y 6/2) silt loam; many, fine and medium, prominent, strong-brown (7.5YR 5/6) mottles and few, fine, prominent, reddish-brown (5YR 4/4) mottles; weak, coarse, prismatic structure parting to weak, medium, platy; friable; common pores; neutral; gradual, wavy boundary.

C—65 to 76 inches, light olive-gray (5Y 6/2) silt loam; many, fine, prominent, strong-brown (7.5YR 5/6) mottles and few, fine, prominent, reddish-brown (5YR 4/4) mottles; massive; very friable; common pores; slight effervescence; mildly alkaline.

The solum is 45 to 70 inches thick, and the depth to free carbonates is 45 to 70 inches. The dark-colored A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 18 inches thick. The B2 horizon is 30 to 48 inches thick. The B3 horizon is 5 to 12 inches thick. The C horizon is silt loam or stratified silt, fine sand, and very fine sand.

Joy soils are near Ossian and Plano soils. Joy soils are somewhat poorly drained; Ossian soils are poorly drained; and Plano soils are well drained and moderately well drained.

JoA—Joy silt loam, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is on low terraces adjacent to flood plains and in drainageways and depressions. The areas are elongated to irregular in shape and cover 3 to 60 acres.

Included with this soil in mapping are small areas of Ossian and Plano soils. In some small areas the surface layer is silty clay loam. In drainageways and depressions the surface layer is thicker than in the representative soil and there is as much as 36 inches of silt loam overwash. Also included are some small areas where this soil is underlain by sand, stratified sand and gravel, or gravelly sandy loam till.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded in some areas during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Where this soil is properly managed, it is suitable for certain vegetable crops. Undrained areas of this soil are suitable for wildlife habitat. Where this soil is drained, it is used for most of the farm crops commonly grown in the county. Some undrained areas are used for unimproved pasture. Capability unit IIw–2; woodland group 4o1; recreation group 6; woodland group 6; tree and shrub group 3.

Kibbie Series

The Kibbie series consists of nearly level and gently sloping, somewhat poorly drained soils in drainageways, depressions, and old glacial lake basins. These soils are loamy and are underlain by stratified silt and very fine sand lacustrine deposits. The native vegetation was dominantly hardwood forest with grasses in openings and in the understory. Unless these soils are drained, they are saturated with water below a depth of 1 to 3 feet during wet periods.

In a representative profile the surface layer is very dark grayish-brown loam about 9 inches thick. The subsurface layer is brown loam about 4 inches thick and has yellowish-brown, grayish-brown, and light brownish-gray mottles. The subsoil is about 23 inches thick and has brown, yellowish-brown, and grayish-brown mottles. It is brown, firm loam in the upper part; brown, firm clay loam in the middle part; and yellowish-brown, very friable silt loam in the lower part. The substratum is brown, very friable, stratified silt and very fine sand to a depth of 60 inches. It has yellowish-brown and grayish-brown mottles.

The available water capacity is high, and permeability is moderate. The depth of root penetration is limited by saturated soil during wet periods. Natural fertility is high. The organic-matter content of the surface layer is moderate.

Where drained, most of the acreage is used for corn, small grains, legumes, and other crops grown in the county. Undrained areas provide good wildlife habitat and some are used for unimproved pasture.

Representative profile of Kibbie loam, 0 to 3 percent slopes, approximately 400 feet east and 1,060 feet north of southwest corner of sec. 23, T. 16 N., R. 13 E., in a formerly cultivated field:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam; moderate, fine and very fine, granular structure; friable; many roots; common pores; mildly alkaline; abrupt, smooth boundary.

A2—9 to 13 inches, brown (10YR 5/3) loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles and common, fine, faint, light brownish-gray (2.5Y 6/2) and grayish-brown (10YR 5/2) mottles; weak, fine, subangular blocky structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; mildly alkaline; clear, smooth boundary.

B21t—13 to 21 inches, brown (10YR 4/3) heavy loam; common, medium, faint, brown (10YR 5/3) mottles, few, fine, faint, grayish-brown (10YR 5/2) mottles, and common, fine, prominent, yellowish-brown (10YR 5/6) mottles; moderate, fine, subangular blocky structure; firm; common roots; common pores; many thin clay films on faces of peds; medium acid; gradual, wavy boundary.

B22t—21 to 33 inches, brown (10YR 4/3) light clay loam; common, fine, prominent, yellowish-brown (10YR 5/6) mottles and few, fine, faint, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; firm; common pores; many thin clay films on faces of peds; neutral; clear, smooth boundary.

IIB3t—33 to 36 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles, few, fine, distinct, grayish-brown (10YR 5/2) mottles, and few, fine, prominent, yellowish-brown (10YR 5/8) mottles; weak, fine, subangular blocky structure; very friable; common pores; many thin clay films on faces of peds; mildly alkaline; clear, wavy boundary.

IIC—36 to 60 inches, brown (10YR 5/3) stratified silt and very fine sand; common, fine and medium, prominent, yellowish-brown (10YR 5/6) mottles and common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; very friable; common pores; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick, and the depth to carbonates is 24 to 40 inches. The Ap or A1 horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 6 to 9 inches thick. The B2t horizon is loam, clay loam, or sandy clay loam 12 to 25 inches thick. The IIB3t horizon is loam or silt loam, and in some places it has thin strata of silt and very fine sand. The IIC horizon is stratified silt and very fine sand, and in some places it contains strata of fine sand, silty clay loam, or silt loam.

Kibbie soils are near Colwood and Sisson soils. Kibbie soils are somewhat poorly drained, Colwood soils are poorly drained, and Sisson soils are well drained.

KbA—Kibbie loam, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is on flood plains and in depressions and old glacial lake basins. The areas of the soil are irregular in shape and cover 3 to 60 acres.

Included with this soil in mapping are small areas of Colwood and Sisson soils. In some places the surface layer is fine sandy loam or loamy fine sand or this soil is underlain by sand, stratified sand and gravel, or stratified lacustrine silt and clay.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded in some areas during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Care must be taken to prevent loose sand from entering tile lines.

Where properly managed, this soil is suitable for certain vegetable crops. Undrained areas are suitable for wildlife habitat. Where this soil is drained, it is used for most of the farm crops commonly grown in the county. Some undrained areas are used for unimproved pasture. Capability unit IIw–2; woodland group 1o2; recreation group 6; wildlife group 6; tree and shrub group 3.

Kidder Series

The Kidder series consists of nearly level to steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 8 inches thick. The subsoil is about 26 inches thick. It is brown, friable fine sandy loam in the upper part; brown, firm sandy clay loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is yellowish-brown, friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage of the nearly level to sloping soils is used for corn, small grains, legumes, and other crops grown in the county. Most of the moderately steep and steep acreage is used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Kidder fine sandy loam, 2 to 6 percent slopes, approximately 1,290 feet west and 450 feet south of the northeast corner of the SE¼ of sec. 3, T. 14 N., R. 11 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine and medium, granular structure; friable; few roots; common pores; some brown (10YR 4/3) subsoil material mixed in by plowing; medium acid; abrupt, smooth boundary.

B1—8 to 11 inches, brown (10YR 4/3) fine sandy loam; weak, fine, subangular blocky structure; friable;

few roots; common pores; some dark grayish-brown (10YR 4/2) soil material in old root and worm channels; slightly acid; clear, smooth boundary.

B21t—11 to 26 inches, brown (7.5YR 4/4) sandy clay loam; weak, fine and medium, subangular blocky structure; firm; few roots; common pores; thin discontinuous clay films on faces of peds and clay flows in old root channels and in pores; neutral; gradual, smooth boundary.

B22t—26 to 34 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; common pores; thin discontinuous clay flows in old root channels and in pores; clay bridging between sand grains; about 5 percent gravel, by volume; slight effervescence; mildly alkaline; clear, smooth boundary.

C—34 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; friable; common pores; about 20 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 28 percent.

The solum is 24 to 40 inches thick and overlies calcareous, gravelly sandy loam glacial till. The Ap horizon is very dark grayish brown, dark grayish-brown, or brown loam or fine sandy loam 6 to 9 inches thick. The B1 horizon is loam or fine sandy loam 3 to 7 inches thick. The B2t horizon is heavy loam, clay loam, heavy sandy loam, or sandy clay loam 10 to 30 inches thick. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 25 percent, by volume.

Kidder soils are near Grellton, Marcellon, and Rotamer soils. They have a thinner solum than Grellton soils and lack the silt loam IIB horizon of Grellton soils. They are well drained, and Marcellon soils are somewhat poorly drained. They have a thicker solum than Rotamer soils.

KdA—Kidder fine sandy loam, 0 to 2 percent slopes. This soil is nearly level and is on broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to 120 acres.

This soil has a surface layer that is about 3 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Marcellon and Okee soils, small areas of gently sloping Kidder soil, and areas where the surface layer is loamy fine sand. In some places this soil has cobbles and boulders on the surface and throughout the solum, or the entire subsoil is sandy loam, or the underlying till is gravelly loamy sand, or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is slow. This soil is subject to soil blowing during dry periods. It has few limitations.

This soil is suitable for all of the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil can be cropped intensively if management includes regular additions of organic matter and maintains tilth. Capability unit I–4; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KdB—Kidder fine sandy loam, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to more than 150 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Marcellon, Lapeer, Mecan, and Okee soils, and small areas of nearly level or sloping and eroded and severely eroded Kidder fine sandy loam. In some places the surface layer is loamy fine sand; or cobbles and boulders are on the surface and throughout the surface layer and subsoil; or the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight. During dry periods this soil is subject to soil blowing.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KdC2—Kidder fine sandy loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on till plains and moraines. Areas are irregular in shape and mostly cover 3 to 80 acres.

This soil has a surface layer that is about 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer, Mecan, Okee, and Oshtemo soils and small areas of gently sloping or moderately steep and uneroded and severely eroded Kidder fine sandy loam. In some places the surface layer is loamy fine sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate. During dry periods this soil is subject to soil blowing.

With proper management, this soil is suitable for all of the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KdD2—Kidder fine sandy loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on the moraines and along drainageways of the till plains. Areas are long and narrow along drainageways and irregularly shaped on moraines. Most areas cover 3 to 50 acres.

This soil has a surface layer that is about 3 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer and Okee soils and of sloping and uneroded and severely eroded Kidder fine sandy loam. In some places the slopes are as much as 30 percent; the surface layer is loamy fine sand; or cobbles and boulders are on the surface and throughout the surface layer and subsoil. In other places the underlying till is gravelly loamy sand, or the substratum is stratified sand and gravel, or dolomite is at a depth of 45 to 50 inches.

Runoff is rapid, and the hazard of erosion is severe. During dry periods, this soil is subject to soil blowing.

This soil is best suited to pasture, woodland, or close-growing crops. Most of the acreage is used for pasture or woodland and some is used for row crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–1; woodland group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeA—Kidder loam, 0 to 2 percent slopes. This soil is nearly level and is on broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to 30 acres.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Marcellon and Okee soils, small areas of gently sloping Kidder loam, and areas where the surface layer is fine sandy loam. In some places cobbles and boulders are on the surface and throughout the surface layer and subsoil; the entire subsoil is sandy loam; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is slow. This soil has few limitations.

This soil is suitable for all of the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil can be cropped intensively if management includes regulating additions of organic matter and maintaining tilth. Capability unit I–4; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeB—Kidder loam, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to 160 acres.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Marcellon, Lapeer, Mecan, and Okee soils and small areas of nearly level and sloping, eroded and severely eroded Kidder loam. In some places the surface layer is fine sandy loam; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel. And in places, dolomite is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capacity unit IIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeC2—Kidder loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on till plains and moraines. Areas are irregular in shape and cover 3 to 50 acres.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer, Mecan, Okee, and Oshtemo soils, and small areas of gently sloping or moderately steep and uneroded and severely eroded Kidder loam. In some places the surface layer is fine sandy loam; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate.

This soil is suitable for all of the farm crops and some of the vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeD2—Kidder loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on the moraines and along drainageways of till plains. Areas are long and narrow along drainageways and irregularly shaped on moraines and cover 3 to 50 acres.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer and Okee soils, and small areas of sloping or steep and uneroded or severely eroded Kidder loam. In some places the surface layer is fine sandy loam; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; the substratum is stratified sand and gravel; or dolomite is at a depth of 45 to 50 inches.

Runoff is rapid, and the hazard of erosion is severe.

This soil is best suited to pasture, woodland, or close-growing crops. Most of the acreage is used for pasture or woodland and some is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IVe–1; woodland group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

KeE—Kidder loam, 20 to 30 percent slopes. This soil is steep and is on moraines and along drainageways of the till plains. Areas are long and narrow along drainageways and irregularly shaped on moraines. They are 3 to 30 acres in size.

This soil has less sand in the surface layer and upper part of the subsoil than the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer soils and of moderately steep and eroded Kidder loam. In some places the surface layer is fine sandy loam; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; the substratum is stratified sand and gravel; or dolomite is at a depth of 45 to 50 inches.

Runoff is rapid, and the hazard of erosion is very severe.

This soil is generally not suited to row crops because the erosion hazard is very severe. Most of the acreage is used for pasture or woodland. Pasture renovation and controlled grazing help maintain plant cover and reduce erosion. Capability unit VIe–1; wood-

land group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

Knowles Series

The Knowles series consists of nearly level to moderately steep, well-drained soils on broad ridgetops and side slopes. These soils are loamy and are underlain by dolomite bedrock. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil is about 28 inches thick. It is yellowish-brown, firm silt loam in the upper part; yellowish-brown, firm silty clay loam in the middle part; and dark yellowish-brown, firm silty clay loam grading to dark yellowish-brown, friable loam in the lower part. Very pale brown, creviced dolomite is at depth of 35 inches.

The available water capacity is moderate, and permeability is moderate. The depth of root penetration is limited by dolomite, but some roots extend into crevices filled with subsoil material. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most of the nearly level to sloping acreage is used for corn, small grains, legumes, and other crops grown in the county. Most of the moderately steep acreage is used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Knowles silt loam, 2 to 6 percent slopes, approximately 660 feet south and 20 feet west of the northeast corner of the SE¼ of sec. 29, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam; weak, coarse, granular structure; friable; few roots; few pores; some yellowish-brown (10YR 5/4) subsoil mixed in by plowing; neutral; abrupt, smooth boundary.

B1—7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; few roots; few pores; a few dark grayish-brown (10YR 4/2) worm casts; light gray (10YR 7/2), when dry, silt grains in old root channels and on faces of some peds; neutral; clear, smooth boundary.

B21t—10 to 13 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium, prismatic structure ture; firm; few roots; few pores; light gray (10YR 7/2), when dry, silt grains on faces of many peds; thin discontinuous clay films on faces of some peds and in old root channels; slightly acid; clear, smooth boundary.

B22t—13 to 22 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky; firm; few roots; few pores; many thin clay films on faces of peds; light gray (10YR 7/2), when dry, silt grains on faces of vertical peds; strongly acid; gradual, wavy boundary.

B23t—22 to 28 inches, yellowish-brown (10YR 5/4) light silty clay loam; moderate, medium, prismatic structure parting to weak, medium, subangular blocky; firm; few roots; few pores; many thin clay films on faces of peds, about half are dark brown (7.5YR 3/2); light gray (10YR 7/2), when dry, silt grains on faces of some peds; strongly acid; clear, smooth boundary.

B24t—28 to 33 inches, dark yellowish-brown (10YR 4/4) heavy silty clay loam; weak, medium, subangular blocky structure; firm; common pores; many thin clay films on faces of peds, about half are dark brown (7.5YR 3/2); few rounded glacial pebbles of mixed origin; neutral; clear, wavy boundary.

IIB25t—33 to 35 inches, dark yellowish-brown (10YR 4/4) loam; weak, medium, subangular blocky structure; friable; few pores; about 10 percent, by volume, is gravel of mixed origin, mainly quartzite and chert; thin patchy clay films on faces of peds and on pebbles; mildly alkaline; abrupt, irregular boundary.

IIIR—35 inches, very pale brown (10YR 7/3) creviced dolomite bedrock.

The solum is 20 to 40 inches thick and overlies dolomite. The silty eolian mantle is 18 to 38 inches thick. The Ap horizon is grayish brown or dark grayish brown and is 6 to 9 inches thick. The B2t horizon is heavy silt loam or silty clay loam 9 to 24 inches thick. The IIB2t horizon is sandy clay loam, clay loam, or loam 2 to 10 inches thick. The dolomite bedrock is creviced in most places. Material from the IIB horizon fills these crevices in many places.

Knowles soils are near Dodge, Lomira, and Ripon soils. Knowles soils are underlain by dolomite bedrock, Dodge soils by gravelly sandy loam glacial till, and Lomira soils by very gravelly sandy loam glacial till which is dominantly angular dolomite fragments. Knowles soils have a lighter-colored or thinner dark-colored A horizon that Ripon soils.

KwA—Knowles silt loam, 0 to 2 percent slopes. This soil is nearly level and is on broad ridgetops where the depth to dolomite is relatively shallow. Areas are elongated or irregular in shape and cover 5 to 40 acres.

This soil has a surface layer that is 2 to 3 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Grellton and St. Charles soils, small areas of gently sloping Knowles silt loam, and some areas where the depth to dolomite ranges from 40 to 60 inches below the surface. In places the surface layer is fine sandy loam, and the entire subsoil is loam, clay loam, or sandy clay loam.

Runoff is slow. This soil has few limitations. Because of the small total acreage, however, it has been placed in a capability grouping with soils that formed in similar material but are subject to erosion.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil can be cropped intensively if management includes regularly adding organic matter and maintaining tilth. The moderate available water capacity and depth to dolomite limit crop yields during most seasons. Capability unit IIe–2; woodland group 2o1; recreation group 4; wildlife group 1; tree and shrub group 1.

KwB—Knowles silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and upper side slopes where the depth to dolomite is relatively shallow. Areas are elongated in shape and cover 3 to 60 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Lomira, Ritchey, and St. Charles soils, and small areas of nearly level or sloping and eroded Knowles silt loam. In some places the depth to dolomite ranges from 40 to 60 inches or the surface layer is fine sandy loam and the entire subsoil is loam, clay loam, or sandy clay loam.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content and good

tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIe–2; woodland group 2o1; recreation group 4; wildlife group 1; tree and shrub group 1.

KwC2—Knowles silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on narrow ridgetops and side slopes where the depth to dolomite is relatively shallow. Areas are elongated in shape and cover 3 to 40 acres.

This soil has a surface layer that is about 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Lomira, Ritchey, and St. Charles soils, and small areas of gently sloping or moderately steep and uneroded or severely eroded Knowles silt loam. In some places the depth to dolomite is 40 to about 55 inches or the surface layer is fine sandy loam and the entire subsoil is loam, clay loam, or sandy clay loam.

Runoff is medium, and the hazard of erosion is moderate.

This soil is suitable for all of the farm crops and some of the vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–2; woodland group 2o1; recreation group 4; wildlife group 1; tree and shrub group 1.

KwD2—Knowles silt loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on side slopes where the depth to dolomite is relatively shallow. Areas are elongated and cover 3 to 25 acres.

This soil has a surface layer that is about 1 to 2 inches thinner and the surface layer and subsoil combined are about 6 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Lomira and Ritchey soils and small areas of sloping and uneroded or severely eroded Knowles silt loam. In some places this soil has slopes of up to 30 percent or a silty mantle that is 38 to 60 inches thick. In places the depth to dolomite is 40 to about 55 inches or the surface layer is fine sandy loam and the entire subsoil is loam, clay loam, or sandy clay loam.

Runoff is rapid, and the hazard of erosion is severe.

This soil is best suited to close growing crops. Most of the acreage is used for pasture or woodland and some is used for crops. The main concerns of management are maintaining the organic-matter content and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IVe–2; woodland group 2r1; recreation group 4; wildlife group 1; tree and shrub group 1

Lapeer Series

The Lapeer series consists of nearly level to steep, well-drained soils on till plains and moraines. These soils have a loamy subsoil underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark yellowish-brown loamy fine sand about 6 inches thick. The subsoil is about 27 inches thick. It is dark-brown, very friable and friable sandy loam in the upper part and brown, very friable gravelly sandy loam in the lower part. The substratum is light-brown, very friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is moderate, and permeablity is moderate. Natural fertility is medium. The organic-matter content of the surface layer is low.

Most of the gently sloping and sloping acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. Most of the moderately steep and steep acreage is used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Lapeer loamy fine sand, 6 to 12 percent slopes, eroded, approximately 130 feet east and 900 feet north of the center of sec. 24, T. 16 N., R. 11 E., in a cultivated field:

Ap—0 to 6 inches, dark yellowish-brown (10YR 3/4) loamy fine sand; weak, fine and medium, granular structure; very friable; common roots; few pores; dark-brown (7.5YR 4/4) subsoil material mixed in by plowing; neutral; abrupt, smooth boundary.

B21t—6 to 12 inches, dark-brown (7.5YR 4/4) heavy sandy loam; moderate, medium, subangular blocky structure; friable; few roots; many pores; many worm and root channels filled with dark yellowish-brown (10YR 3/4) soil material; thin patchy clay films on faces of some peds and in some pores and channels; clay bridging between sand grains; slightly acid; clear, smooth boundary.

B22t—12 to 21 inches, dark-brown (7.5YR 4/4) sandy loam; weak, fine and medium, subangular blocky structure; friable; few roots; few pores; few, thin, patchy clay films in pores and channels and on pebbles; clay bridging between sand grains; about 10 percent clay; slightly acid; gradual, wavy boundary.

B23t—21 to 28 inches, dark-brown (7.5YR 4/4) light sandy loam; weak, medium, subangular blocky structure; very friable; few roots; few pores; clay bridging between sand grains; slightly acid; gradual, wavy boundary.

B3—28 to 33 inches, brown (7.5YR 5/4) gravelly light sandy loam; weak, medium and coarse, subangular blocky structure; very friable; few roots; few pores; about 15 percent gravel, by volume; strong effervescence; mildly alkaline; clear, wavy boundary.

C—33 to 60 inches, light-brown (7.5YR 6/4) gravelly sandy loam; massive; very friable; about 15 percent gravel, by volume; violent effervescence; moderately alkaline; calcium carbonate equivalent is 22 percent.

The solum is 24 to 40 inches thick and overlies calcareous, gravelly sandy loam glacial till. The Ap horizon is loamy fine sand or fine sandy loam. It is dark brown, dark yellowish brown, verv dark grayish brown, or dark grayish brown and is 6 to 10 inches thick. The B2t horizon is sandy loam or light sandy clay loam and is 10 to 26 inches thick. Clay content of the Bt horizon averages from 8 to 12 percent. Gravel content ranges from a trace to about 20 percent, by volume. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 26 percent, by volume.

Lapeer soils are near Mecan and Okee soils. They have a thinner solum than Mecan soils. They lack the 20- to 40-inch thick sand or loamy sand mantle of Okee soils.

LaB—Lapeer loamy fine sand, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors of till plains. Areas are irregular in shape and cover 3 to 160 acres.

This soil has a surface layer about 4 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas

of Kidder, Mecan, Oakville, Okee, and Rotamer soils and small areas of nearly level or sloping or eroded Lapeer loamy fine sand. In some places the surface layer is fine sandy loam or sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel.

Runoff is medium, and the hazard of erosion is slight. During dry periods this soil is subject to soil blowing.

This soil is suitable for all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 1.

LaC2—Lapeer loamy fine sand, 6 to 12 percent slopes, eroded. This soil is sloping and is on till plains and moraines. Areas are elongated and cover 3 to 140 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Kidder, Oakville, Okee, and Rotamer soils and small areas of gently sloping or moderately steep and uneroded Lapeer loamy fine sand. In some places the surface layer is fine sandy loam or sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate. During dry periods this soil is subject to soil blowing.

Where managed properly, this soil is suitable for all the farm crops commonly grown in the county but is best suited to close growing crops. Most of the acreage is used for general farm crops and some is in native woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 1.

LaD2—Lapeer loamy fine sand, 12 to 25 percent slopes, eroded. This soil is moderately steep and steep and is on the moraines and along drainageways of till plains. Areas are long and narrow along drainageways and irregularly shaped on moraines. The areas cover 3 to 40 acres.

This soil has a surface layer that is slightly thinner and lighter colored and the surface layer and subsoil combined are about 4 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Kidder, Oakville, Okee, and Rotamer soils and small areas of sloping and uneroded and severely eroded Lapeer loamy fine sand. In some places the surface layer is fine sandy loam or sand; numerous cobbles and boulders are on the surface and throughout the surface layer and subsoil; the underlying till is gravelly loamy sand; or the substratum is stratified sand and gravel.

Runoff is medium, and the hazard of erosion is severe. During dry periods this soil is subject to soil blowing.

This soil is best suited to woodland. It is generally not suited to cultivated crops. Most of the acreage is in hay, pasture, or native woodland. Many areas that were once cultivated are now in pasture or woodland. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIe–4; woodland group 3r1; recreation group 2; wildlife group 1; tree and shrub group 1.

Lb—Lapeer fine sandy loam, 0 to 2 percent slopes. This soil is nearly level and is on valley floors and broad ridgetops of the till plains. Areas are irregular in shape and cover 3 to 40 acres.

This soil has a surface layer about 4 to 6 inches thicker and darker colored than the surface layer of the soil described as representative of the series.

Included with this soil in mapping are small areas of Griswold, Kidder, and Mecan soils and areas of gently sloping Lapeer fine sandy loam. In some places the surface layer is loam or loamy fine sand, or the subsoil is loamy sand, or silt loam deposits are below a depth of 36 inches.

Runoff is slow. This soil is subject to soil blowing during dry periods.

This soil is suitable for all the general farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, and controlling soil blowing. Capability unit IIIs–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 1.

LeRoy Series

The LeRoy series consists of sloping and moderately steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by very gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is about 12 inches thick. It is brown, firm silty clay loam in the upper part and dark-brown, firm clay loam in the lower part. The substratum is brown, friable very gravelly sandy loam to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most areas of sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep soils are used for hay, pasture, woodland, or wildlife habitat.

Representative profile of LeRoy silt loam, 12 to 20 percent slopes, eroded, approximately 1,200 feet east and 860 feet south of the center of sec. 14, T. 16 N., R. 13 E., in a cultivated field:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, granular structure; friable; few roots; common pores; some brown (7.5YR 4/4) subsoil mixed in by plowing; neutral; abrupt, smooth boundary.

B21t—6 to 10 inches, brown (7.5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; few pores; dark grayish-brown

(10YR 4/2) soil material in old root and worm channels; many thin clay films on faces of peds; neutral; clear, smooth boundary.

IIB22t—10 to 18 inches, dark-brown (7.5YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; few roots; few pores; many thin clay films on faces of peds; about 5 percent gravel, by volume, mostly partially weathered dolomite and angular chert fragments; neutral; clear, smooth boundary.

IIC—18 to 60 inches, brown (10YR 5/3) very gravelly sandy loam; massive; friable; about 50 percent coarse fragments, by volume, that are mostly angular dolomite less than 3 inches in diameter and some flags as much as 12 inches in length; violent effervescence; moderately alkaline; calcium carbonate equivalent is 63 percent.

The solum is 12 to 24 inches thick and overlies calcareous, very gravelly sandy loam glacial till. The silty eolian mantle is 10 to 20 inches thick. The Ap horizon is dark grayish brown or grayish brown and is 6 to 9 inches thick. The B2t horizon is 4 to 12 inches thick. The IIB2t horizon is loam, clay loam, or sandy clay loam and is 2 to 8 inches thick. Coarse fragments, including dolomite cobbles and boulders, in the IIC horizon range from 30 to 60 percent, by volume. The calcium carbonate equivalent ranges from 60 to 90 percent.

LeRoy soils are near Lomira and Ritchey soils and are similar to Markesan soils. They have a thinner solum than Lomira soils. LeRoy soils are underlain by very gravelly sandy loam till and Ritchey soils by dolomite bedrock. LeRoy soils have a lighter-colored or a thinner dark-colored A horizon that Markesan soils.

LrC2—LeRoy silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on narrow ridgetops and side slopes of the till plains. Areas are elongated and cover 3 to 60 acres.

This soil has a surface layer that is 1 to 2 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Ritchey and Rotamer soils and small areas of moderately steep and uneroded or severely eroded LeRoy silt loam. In some areas dolomite fragments are on the surface and throughout the surface layer and subsoil or dolomite is at a depth of 30 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate. In some places tillage is hampered by dolomite fragments.

With proper management this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

LrD2—LeRoy silt loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on side slopes of ridges and drainageways on till plains. Areas are elongated in shape and cover 3 to 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Ritchey soils, small areas of sloping and uneroded or severely eroded LeRoy silt loam, and small areas that have slopes of up to 25 percent. In some places dolomite fragments are on the surface and throughout the surface layer and subsoil, or dolomite is at a depth of 30 to 60 inches.

Runoff is rapid, and the hazard of erosion is severe. In some places tillage is hampered by dolomite fragments.

This soil is best suited to pasture, woodland, or close-growing crops. Most of the acreage is used for pasture and hay but some is used for row crops. Some of the acreage is in woodland. The main concerns of management are maintaining organic-matter content and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IVe–1; woodland group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

Lomira Series

The Lomira series consists of gently sloping to moderately steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by very gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown silt loam about 8 inches thick. The subsoil is about 27 inches thick. It is yellowish-brown, friable and firm silt loam in the upper part; yellowish-brown, firm silty clay loam in the middle part; and dark yellowish-brown, firm clay loam in the lower part. The substratum is pale brown, friable very gravelly sandy loam to a depth of 60 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderately low to moderate.

Most areas of gently sloping and sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep soils are used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Lomira silt loam, 2 to 6 percent slopes, approximately 60 feet east and 1,190 feet north of the southwest corner of the SE ¼ of sec. 34, T. 16 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable; few roots; few pores; some yellowish-brown (10YR 5/4) subsoil material mixed in by plowing; neutral; abrupt, smooth boundary.

B1—8 to 13 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; few roots; few pores; dark grayish-brown (10YR 4/2) soil material in earthworm casts and old root channels; light gray (10YR 7/2), when dry, silt coatings on faces of most peds; neutral; clear, smooth boundary.

B21t—13 to 23 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak, fine, subangular blocky structure; firm; few roots; few pores; thin discontinuous clay films on faces of some peds and in old root channels; light gray (10YR 7/2), when dry, silt coatings on faces of most peds; slightly acid; gradual, smooth boundary.

B22t—23 to 29 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, fine and medium, angular and subangular blocky structure; firm; few pores; thick continuous clay films on faces of all peds and thick black (10YR 2/1) clay films on faces of some peds and in old root channels; medium acid; clear, wavy boundary.

IIB23t—29 to 35 inches, dark yellowish-brown (10YR 4/4) clay loam; moderate, medium, subangular blocky structure; firm; few pores; thick continuous clay films on faces of all peds and thick black (10YR

2/1) clay films on faces of some peds and in old root channels; about 5 percent gravel, by volume; slightly acid; clear, wavy boundary.

IIC—35 to 60 inches, pale-brown (10YR 6/3) very gravelly sandy loam; massive; friable; few pores; about 60 percent angular gravel, by volume, mostly dolomite fragments; violent effervescence; moderately alkaline; calcium carbonate equivalent is 83 percent.

The solum is 24 to 40 inches thick and overlies calcareous, very gravelly sandy loam glacial till. The silty eolian mantle is 26 to 36 inches thick. The Ap horizon is brown, dark grayish brown, or very dark grayish brown and is 6 to 9 inches thick. The B2t horizon is heavy silt loam or silty clay loam and is 12 to 24 inches thick. The IIBt horizon is loam, clay loam, or sandy clay loam and is 2 to 6 inches thick. Gravel in the IIBt horizon ranges from 5 to 25 percent, by volume. Coarse fragments, including dolomite cobbles and boulders, in the IIC horizon range from 30 to 60 percent, by volume. The calcium carbonate equivalent ranges from 60 to 90 percent.

Lomira soils are near Knowles, LeRoy, and St. Charles soils. Lomira soils are underlain by very gravelly sandy loam till and Knowles soils by dolomite. They have a thicker solum than LeRoy soils. They have a thinner mantle of silty eolian sediments and a thinner solum than St. Charles soils.

LvB—Lomira silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors of till plains. Areas are elongated to irregular in shape and cover 3 to 150 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Knowles and LeRoy soils and small areas of nearly level or sloping and eroded or severely eroded Lomira silt loam. Also included are small areas where the underlying till is very gravelly loam and areas where dolomite is at a depth of 40 to 60 inches.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

LvC2—Lomira silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes of broad ridges on till plains. Areas are elongated to irregular in shape and cover 3 to 95 acres.

This soil has a surface layer that is about 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Knowles soils and small areas of gently sloping or moderately steep and uneroded or severely eroded Lomira silt loam. In small areas the underlying till is very gravelly loam or dolomite is at a depth of 40 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate.

This soil is suitable for all the farm and some of the vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIIe–1; woodland group 2o1; recreation group 1; wildlife group 1; tree and shrub group 1.

LvD2—Lomira silt loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on side slopes of broad ridges and drainageways of the till plains. Areas are elongated and cover 3 to 30 acres.

This soil has a surface layer that is about 3 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Knowles soils and of sloping and uneroded or severely eroded Lomira silt loam. In some places slopes are up to 30 percent; a silty mantle is 36 to 60 inches thick; the underlying till is very gravelly loam; or the till contains less than 30 percent coarse fragments, by volume. And in places, dolomite is at a depth of 40 to 60 inches.

Runoff is rapid, and the hazard of erosion is severe.

This soil is best suited to pasture, woodland, or close growing crops. Most of the acreage is used for pasture or woodland and some is used for row crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IVe–1; woodland group 2r1; recreation group 1; wildlife group 1; tree and shrub group 1.

Manawa Series

The Manawa series consists of nearly level and gently sloping, somewhat poorly drained soils in drainageways, depressions, and old glacial lake basins and on low terraces. These soils have clayey subsoils underlain by clay, silty clay, or silty clay loam. The native vegetation was hardwood forest with prairie grasses in the understory. Unless these soils are drained, they are saturated with water below a depth of 1 to 3 feet during wet periods.

In a representative profile the surface layer is black silt loam about 9 inches thick. The subsoil is about 17 inches thick and has reddish-brown, gray, and light brownish-gray mottles. It is reddish-brown, firm clay in the upper part and grayish-brown, firm clay in the lower part. The substratum is strong-brown, firm silty clay loam in the upper part and reddish-brown, firm silty clay loam to a depth of 60 inches. The upper part of the substratum has gray mottles.

The available water capacity is high, and permeability is slow. The depth of root penetration is limited by saturated soil during wet periods of the growing season. Natural fertility is high. The organic-matter content of the surface layer is moderate.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wildlife habitat and some are used for unimproved pasture.

Representative profile of Manawa silt loam, 0 to 3 percent slopes, approximately 500 feet south and 1,180 feet west of the northeast corner of sec. 1, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 6 inches, black (N 2/0) silt loam; weak, fine and medium, subangular blocky structure; friable; common roots; common pores; mildly alkaline; abrupt, smooth boundary.

A12—6 to 9 inches, black (N 2/0) heavy silt loam; weak, medium, subangular blocky structure; friable; few roots; common pores; mildly alkaline; clear, smooth boundary.

B21t—9 to 16 inches, reddish-brown (5YR 4/4) clay; few, fine, distinct, light brownish-gray (10YR 6/2) mottles; weak, medium, subangular blocky structure; firm; few roots; common pores; black (N 2/0) soil material in worm channels and on some faces of peds and thin continuous clay films on faces of peds; mildly alkaline; clear, smooth boundary.

B22t—16 to 26 inches, grayish-brown (2.5Y 5/2) clay; many, fine, prominent, reddish-brown (5YR 5/3) and common, medium, faint, gray (5Y 5/1) mottles; weak, medium, subangular blocky structure parting to moderate, very fine, subangular blocky; firm; few roots; common pores; thin continuous clay films on faces of peds; mildly alkaline; abrupt, smooth boundary.

IIC1—26 to 36 inches, strong-brown (7.5YR 5/6) silty clay loam; common, fine, prominent, gray (5Y 5/1) mottles; weak, medium, subangular blocky structure; firm; few pores; strong effervescence; moderately alkaline; gradual, irregular boundary.

IIC2—36 to 60 inches, reddish-brown (5YR 4/4) silty clay loam; massive; firm; few pores; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick, which is also the depth to free carbonates. The A1 or Ap horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 6 to 9 inches thick. The B2t horizon is clay or silty clay and is 12 to 32 inches thick. The IIC horizon is clay, silty clay, or silty clay loam.

Manawa soils are near Briggsville, Poygan, and Zittau soils. Manawa soils are somewhat poorly drained, Briggsville soils are well drained and moderately well drained, and Poygan soils are poorly drained. Manawa soils lack the sand C horizon characteristic of Zittau soils.

MaA—Manawa silt loam, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is in drainageways, depressions, and old glacial lake basins and on low terraces. Areas are elongated or irregular in shape and cover 3 to 90 acres.

Included with this soil in mapping are small areas of Briggsville, Poygan, and Zittau soils. In some places the surface layer is silty clay loam, loam, fine sandy loam, or loamy fine sand or the subsoil is sandy loam, loam, or clay loam to a depth of 30 inches. Also included are small areas that are underlain by glacial till.

Runoff is slow. This soil receives runoff from adjoining areas and is subject to ponding during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Tile drains are used for internal drainage.

Undrained areas are suitable for wildlife habitat. Some undrained areas are used for unimproved pasture. Where drained, the acreage is used for most of the farm crops commonly grown in the county. Capability unit IIw–2; woodland group 2c2; recreation group 6; wildlife group 6; tree and shrub group 3.

Marcellon Series

The Marcellon series consists of nearly level and gently sloping, somewhat poorly drained soils along the edges of flood plains and in drainageways and depressions of the till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was dominantly hardwoods such as elm, soft maple, ash, and hickory with grasses in openings and in the understory. Unless these soils are drained, they are saturated with water below a depth of 1 to 3 feet during wet periods.

In a representative profile the surface layer is very dark grayish-brown loam about 9 inches thick. The subsoil is about 26 inches thick and has brown, yellowish-brown, grayish-brown, and yellowish-red mottles. It is yellowish-brown, firm loam in the upper part; brown, firm clay loam in the middle part; and dark yellowish-brown, friable sandy loam in the lower part. The substratum is yellowish-brown, very friable gravelly sandy loam to a depth of 60 inches. It has yellowish-brown mottles.

The available water capacity is high, and permeability is moderate. Depth of root penetration is limited by saturated soil during wet periods of the growing season. Natural fertility is high. The organic-matter content of the surface layer is moderate.

Where drained, most of the acreage is used for corn, small grains, hay, and pasture. Undrained areas provide good wildlife habitat and some are used for unimproved pasture.

Representative profile of Marcellon loam, 0 to 3 percent slopes, 1,120 feet east and 50 feet south of the northwest corner of the SW¼ sec. 34, T. 15 N., R. 12 E., in a cultivated field:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loam; weak, fine, subangular blocky structure; friable; common roots; common pores; neutral; abrupt, smooth boundary.

B21t—9 to 13 inches, yellowish-brown (10YR 5/4) heavy loam; common, fine, distinct, yellowish-red (5YR 4/6) and common, fine, distinct, grayish-brown (10YR 5/2) mottles; moderate, fine, subangular blocky structure; firm; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels and many thin clay films on faces of peds and in pores and channels; mildly alkaline; clear, smooth boundary.

B22t—13 to 30 inches, brown (10YR 5/3) clay loam; common, fine, faint, grayish-brown (10YR 5/2) mottles, and few, fine, faint, brown (7.5YR 4/4) mottles; weak, fine, prismatic structure parting to moderate, fine, subangular blocky; firm; common roots; common pores; many thin clay films on faces of peds and in pores and channels; mildly alkaline; clear, wavy boundary.

B3t—30 to 35 inches, dark yellowish-brown (10YR 4/4) heavy sandy loam; common, fine, distinct, grayish-brown (10YR 5/2) mottles; weak, fine, subangular blocky structure; friable; common roots; common pores; few thin clay films on faces of peds and in pores and channels; clay bridging between sand grains; moderately alkaline; clear, wavy boundary.

C—35 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very friable; few roots; about 20 percent gravel, by volume; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick and overlies calcareous gravelly sandy loam till. The A1 or Ap horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 6 to 9 inches thick. The B2t horizon is heavy loam, clay loam, or sandy clay loam and is 12 to 24 inches thick. The B3t horizon is light loam or heavy sandy loam and is 2 to 8 inches thick. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 25 percent, by volume.

These soils have a slightly thinner dark-colored A horizon than is defined as the range of the series, but this difference does not alter their usefulness or behavior.

Marcellon soils are near Barry, Griswold, and Kidder soils. Marcellon soils are somewhat poorly drained, Barry soils are poorly drained, and Griswold and Kidder soils are well drained.

McA—Marcellon loam, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is along the edges

of flood plains and in drainageways and depressions of the till plains.

Included with this soil in mapping are small areas of Barry, Griswold, Kidder, and Lapeer soils. In some small areas Marcellon loam has slopes of up to 11 percent; the surface layer is fine sandy loam or loamy fine sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil; or the underlying till is gravelly loamy sand.

Runoff is slow. This soil receives runoff from adjoining areas and is subject to ponding during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Tile drains are used for internal drainage of this soil.

Where properly managed, this soil is suitable for certain vegetable crops. Undrained areas are suitable for wildlife habitat. Where drained, the acreage is used for most of the farm crops commonly grown in the county. Some undrained areas are used for unimproved pasture. Capability unit IIw–2; woodland group 2o1; recreation group 6; wildlife group 6; tree and shrub group 3.

Markesan Series

The Markesan series consists of gently sloping to moderately steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by very gravelly sandy loam glacial till. The native vegetation was prairie grasses and some bur oak.

In a representative profile the surface layer is very dark grayish-brown silt loam about 7 inches thick (fig. 7). The subsoil is about 9 inches thick. It is brown, friable silt loam in the upper part and dark yellowish-brown, firm silty clay loam in the lower part. The substratum is yellowish-brown, very friable very gravelly sandy loam to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is moderate to high.

Most areas of gently sloping and sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep soils are used for hay, pasture, or wildlife habitat.

Representative profile of Markesan silt loam, 6 to 12 percent slopes, eroded, approximately 300 feet east and 1,190 feet south of the northwest corner of sec. 11, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and medium, granular structure; very friable; few roots; few pores; some brown (10YR 4/3) subsoil material mixed in by plowing; neutral; abrupt, smooth boundary.

B21t—7 to 13 inches, brown (10YR 4/3) heavy silt loam; moderate, fine and very fine, subangular blocky structure; friable; few roots; few pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; thin clay films on faces of most peds and in pores and channels; about 16 percent sand, by volume; slightly acid; clear, wavy boundary.

B22t—13 to 16 inches, dark yellowish-brown (10YR 3/4) light silty clay loam; moderate, fine and very fine, subangular blocky structure; firm; few roots; few pores; thin clay films on faces of most peds and in pores and channels; about 17 percent sand, by volume; neutral; clear, irregular boundary.

IIC—16 to 60 inches, yellowish-brown (10YR 5/4) very gravelly sandy loam; massive; very friable; about 50 percent gravel, by volume, mostly angular dolomite fragments; violent effervescence; moderately alkaline; calcium carbonate equivalent is 80 percent.

Figure 7.—**Profile of a Markesan soil underlain by very gravelly sandy loam glacial till at a depth of about 22 inches.**

The solum is 12 to 24 inches thick and overlies calcareous, very gravelly sandy loam glacial till. The silty mantle is 10 to 20 inches thick. The A horizon is very dark gray, very dark grayish brown, or very dark brown and is 5 to 12 inches thick. The B2t horizon is heavy silt loam or silty clay loam that has more than 15 percent sand coarser than very fine sand. Coarse fragments, including dolomite cobbles and boulders, in the IIC horizon range from 30 to 60 percent, by volume. The calcium carbonate equivalent is 60 to 90 percent.

Markesan soils are near LeRoy and Mendota soils. They have a darker-colored or thicker dark-colored A horizon than LeRoy soils. They have a thinner silty mantle and a thinner solum than Mendota soils.

MdB2—Markesan silt loam, 2 to 6 percent slopes, eroded. This soil is gently sloping and is on the broad ridgetops and low hills of the till plains. Areas are irregular in shape and cover 3 to 50 acres.

This soil has a surface layer that is about 1 inch thicker and the surface layer and subsoil combined are about 4 inches thicker than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Ritchey soils and areas of nearly level or sloping and uneroded or severely eroded Markesan silt loam. Some areas have dolomite fragments on the surface and throughout the surface layer and subsoil. The soil in many of these areas is thinner to glacial till than is typical and lacks subsoil development. Also included are small areas where the underlying till is very gravelly loam. And in places dolomite is at a depth of 30 to 60 inches.

Runoff is medium, and the hazard of erosion is slight. In some places tillage is hampered by dolomite fragments.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

MdC2—Markesan silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes of broad ridges on till plains. Areas are elongated and cover 3 to 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Ritchey soils and gently sloping or moderately steep and uneroded or severely eroded Markesan silt loam. Some areas have dolomite fragments on the surface and throughout the surface layer and subsoil. The soil in many of these areas is thinner to the glacial till than is typical and lacks subsoil development. Also included are small areas where the underlying till is very gravelly loam. And in places dolomite is at a depth of 25 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate. In some places tillage is hampered by dolomite fragments.

With proper management this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

MdD2—Markesan silt loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on side slopes of drainageways and broad ridgetops on till plains. Areas are elongated and cover 3 to 25 acres.

This soil has a surface layer that is about 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Ritchey soils and areas of sloping and uneroded or severely eroded Markesan silt loam. Some areas have slopes as a steep as 25 percent or have dolomite fragments on the surface and throughout the surface layer and subsoil. The soil in many of these areas is thinner to the glacial till than is typical and lacks subsoil development. Also included are small areas where the underlying till is very gravelly loam. And in places, dolomite is at a depth of 25 to 60 inches.

Runoff is rapid, and the hazard of erosion is severe. In places tillage is hampered by dolomite fragments.

This soil is best suited to pasture or close growing crops. Most of the acreage is used for pasture and some is used for row crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IVe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

Marsh

Mf—Marsh. This mapping unit consists of very poorly drained, nearly level, mineral or organic soil material on flood plains and in depressions and old glacial lake basins. Areas are generally elongated or rounded and cover 5 to 65 acres. Unless this soil is drained, ground water is above or near the surface throughout the year (fig. 8). Vegetation is generally marsh grasses, reeds, cattails, and some water-tolerant shrubs.

Included in mapping are small areas of Adrian, Barry, Colwood, Granby, Houghton, Marshan, and Palms soils. Also included are small areas of open water.

Marsh is flooded for long periods and is too wet for farm crops, pasture, or trees. It cannot generally be drained because of its low position on the landscape. It is best suited for recreation or for wetland wildlife habitat, particularly for furbearers and waterfowl. Capability unit VIIIw–15; woodland group 6w1; recreation group 8; wildlife group 7; tree and shrub group not assigned.

Marshan Series

The Marshan series consists of nearly level, poorly drained soils on flood plains and in depressions, drainageways, and old glacial lake basins. These soils are loamy and are underlain by sand. The native vegetation was mainly marsh grasses and shrubs with some trees such as elm and soft maple. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is about 18 inches thick. It is very dark gray silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The lower part has yellowish-brown mottles. The subsoil is about 15 inches thick and has yellowish-brown mottles. It is dark-gray, firm silty clay loam that has moderate sand content in the upper part; gray, friable silt loam that has moderate sand content in the middle part; and mixed yellowish-brown, dark-gray, and light brownish-gray, friable loam in the lower part. The substratum has dark grayish-brown mottles. It is mixed yellowish-brown and grayish-brown, loose sand in the upper part and yellowish-brown, loose sand to a depth of 60 inches.

The available water capacity is moderate. Permeability is moderate in the subsoil and rapid in the substratum. Depth of root penetration is limited by the water table or, in drained areas, by the underlying

Figure 8.—**Area of Marsh that is wet most of the year. Drainage is not practical.**

sand. Natural fertility is medium. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, legumes, and pasture. Undrained areas provide good wetland wildlife habitat, and some areas are used for unimproved pasture.

Representative profile of Marshan silt loam approximately 700 feet west and 200 feet north of the southeast corner of the NW ¼ of sec. 9, T. 17 N., R. 12 E., in a cultivated field:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; weak, medium, subangular blocky structure; very friable; common roots; common pores; slightly acid; abrupt, smooth boundary.

A12—8 to 18 inches, very dark grayish-brown (2.5Y 3/2) silt loam; common, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very friable; few roots; few pores; slightly acid; clear, smooth boundary.

B21g—18 to 22 inches, dark-gray (10YR 4/1) silty clay loam that has more than 15 percent sand, by volume, coarser than very fine sand; many, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; firm; common pores; neutral; abrupt, smooth boundary.

B22g—22 to 28 inches, gray (10YR 5/1) silt loam that has more than 15 percent sand, by volume, coarser than very fine sand; common, medium, prominent, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; common pores; slightly acid; gradual, wavy boundary.

B3—28 to 33 inches, mixed yellowish-brown (10YR 5/6), dark-gray (10YR 4/1), and light brownish-gray (2.5Y 6/2) loam; very weak, medium, subangular blocky structure; friable; common pores; mildly alkaline; abrupt, smooth boundary.

IIC1—33 to 50 inches, mixed yellowish-brown (10YR 5/4) and grayish-brown (2.5Y 5/2) sand; many, coarse, distinct, dark grayish-brown (10YR 4/2) mottles; single grained; loose; mildly alkaline; gradual, wavy boundary.

IIC2—50 to 60 inches, yellowish-brown (10YR 5/6) sand; few, medium, prominent, dark grayish-brown (10YR 4/2) mottles; single grained; loose, mildly alkaline.

The solum is 24 to 40 inches thick and depth to free carbonates is 50 to 75 inches. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 20 inches thick. The B2g horizon is loam, clay loam, silt loam, or silty clay loam and is 8 to 24 inches thick.

Marshan soils are near Adrian and Colwood soils. They lack the 16- to 50-inch organic layer of Adrian soils. Marshan soils are underlain by outwash sand and Colwood soils by stratified, lacustrine silt loam, silt, fine sand, and very fine sand.

Mh—Marshan silt loam. This soil is nearly level and is on flood plains and in depressions, drainageways, and

old glacial lake basins. Areas are irregular in shape and cover 3 to 160 acres.

Included with this soil in mapping are small areas of Adrian, Barry, Colwood, Ossian, and Palms soils. In some small areas the surface layer is organic and is as much as 16 inches thick or thin loamy strata are in the underlying sand.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Care must be taken to prevent loose sand from entering the tile lines.

Undrained areas are suitable for wetland wildlife habitat. Some undrained acreage is used for unimproved pasture. Where drained, acreage is used for corn, legumes, and pasture. Capability unit IIw–5; woodland group 4w2; recreation group 7; wildlife group 7; tree and shrub group 3.

Mecan Series

The Mecan series consists of gently sloping and sloping, somewhat excessively drained soils on broad ridgetops and valley floors of the till plains. These soils have a loamy subsoil underlain by gravelly loamy sand glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 9 inches thick. The subsurface layer is yellowish-brown loamy fine sand about 9 inches thick. The subsoil is about 28 inches thick. It is dark-brown, very friable sandy loam in the upper part; brown, friable sandy loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is yellowish-brown, very friable gravelly loamy sand to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is low.

Most areas of gently sloping and sloping soils are used for corn, small grains, legumes, and other crops grown in the county. A few areas are in woodland or wildlife habitat.

Representative profile of Mecan loamy fine sand, 2 to 6 percent slopes, approximately 330 feet north and 800 feet east of the southwest corner of the NW ¼ of sec. 33, T. 15 N., R. 11 E., in a cultivated field:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, medium, granular structure; very friable; few roots; common pores; some yellowish-brown (10YR 5/4) subsurface soil mixed in by plowing; neutral; abrupt, smooth boundary.

A2—9 to 18 inches, yellowish-brown (10YR 5/4) loamy fine sand; weak, medium, subangular blocky structure; very friable; few roots; common pores; dark grayish-brown (10YR 4/2) soil material in earthworm casts and in old root channels; neutral; gradual, wavy boundary.

B21t—18 to 24 inches, dark-brown (7.5YR 4/4) light sandy loam; moderate, medium, subangular blocky structure; very friable; few roots; few pores; clay bridging between sand grains; slightly acid; clear, wavy boundary.

B22t—24 to 35 inches, brown (7.5YR 4/4) sandy loam; moderate, medium, subangular blocky structure; friable; few pores; very pale brown (10YR 8/3), when dry, silt coatings on faces of some peds; thin patchy clay films on faces of some peds and in pores and channels; clay bridging between sand grains; slightly acid; gradual, wavy boundary.

B23t—35 to 42 inches, brown (7.5YR 4/4) heavy sandy loam; moderate, medium, subangular blocky structure; friable; few pores; very pale brown (10YR 8/3), when dry, silt coatings on faces of most peds and thin patchy clay films on faces of some peds and in pores and channels; clay bridging between sand grains; slightly acid; clear, smooth boundary.

B24t—42 to 46 inches, brown (7.5YR 4/4) sandy loam; weak, medium, subangular blocky structure; friable; few pores; clay bridging between sand grains; neutral; clear, wavy boundary.

C—46 to 60 inches, yellowish-brown (10YR 5/4) gravelly heavy loamy sand; massive; very friable; strong effervescence; moderately alkaline; calcium carbonate equivalent is 20 percent.

The solum is 40 to 60 inches thick and overlies calcareous gravelly loamy sand glacial till. The Ap horizon is dark grayish brown, very dark grayish brown, or dark brown and is 6 to 10 inches thick. The Bt horizon is mainly sandy loam but has a thin layer of light sandy clay loam in places. The Bt horizon is 25 to 40 inches thick. The C horizon is gravelly heavy loamy sand or gravelly sandy loam. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 25 percent, by volume.

Mecan soils are near Lapeer, Okee, and Urne soils. They have a thicker solum than Lapeer soils. Mecan soils lack the 20- to 40-inch thick sandy mantle of the Okee soils. They have a thicker solum than Urne soils and lack the sandstone substratum of Urne soils.

MnB—Mecan loamy fine sand, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and valley floors on till plains. Most areas are elongated and cover 3 to 150 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Kidder, Oakville, Okee, Oshtemo, and Urne soils. Also included are small areas of sloping and eroded Mecan loamy fine sand and areas that have slopes of less than 2 percent. In some places the surface layer is fine sand; or cobbles and boulders are on the surface and throughout the surface layer and subsoil.

Runoff is slow. The hazard of erosion is slight. This soil is subject to soil blowing.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and certain vegetable crops. Most of the acreage is used for general farm crops but some is in native woodland. Some of the acreage has been planted to pine trees. Fertilization, supplemental irrigation, and protection from soil blowing insure dependable crop production. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIe–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 1.

MnC2—Mecan loamy fine sand, 6 to 12 percent slopes, eroded. This soil is sloping and is on till plains and moraines. Areas are elongated and cover 3 to 70 acres.

This soil has a surface layer that is about 3 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Kidder, Oakville, Okee, Oshtemo, and Urne soils; areas of gently sloping and uneroded Mecan loamy

fine sand; and areas that have slopes as much as 20 percent. In some places the surface layer is fine sand; cobbles and boulders are on the surface and throughout the surface layer and subsoil or a thin layer of stratified sand and gravel is below the subsoil and above the till.

Runoff is medium. The hazard of erosion is moderate. This soil is subject to soil blowing.

Where managed properly, this soil is suitable for all of the farm crops commonly grown in the county. Most of the acreage is used for general farm crops and some is in native woodland. Some has been planted to pine trees. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 1.

Mendota Series

The Mendota series consists of nearly level to sloping, well-drained soils on till plains and moraines. These soils are loamy and are underlain by very gravelly sandy loam glacial till. The native vegetation was prairie grasses.

In a representative profile the surface layer is very dark gray silt loam about 8 inches thick. The subsoil is about 25 inches thick. It is dark brown, friable silt loam in the upper part; brown, friable silt loam in the middle part; and yellowish-brown, very friable gravelly loam in the lower part. The substratum is pale-brown, very friable very gravelly sandy loam to a depth of 60 inches.

The available water capacity is high and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other crops grown in the county.

Representative profile of Mendota silt loam, 2 to 6 percent slopes, approximately 260 feet south and 700 feet west of the northeast corner of sec. 12, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark gray (10YR 3/1) silt loam; weak, fine and medium, granular structure; very friable; few roots; few pores; some dark-brown (10YR 3/3) subsoil mixed in by plowing; slightly acid; abrupt, smooth boundary.

B1—8 to 13 inches, dark-brown (10YR 3/3) silt loam; weak, medium, prismatic structure parting to weak, fine, subangular blocky; friable; few roots; few pores; many worm channels filled with very dark gray (10YR 3/1) soil material; thin discontinuous clay films on faces of some peds and in some pores and channels; medium acid; clear, smooth boundary.

B21t—13 to 22 inches, brown (10YR 4/3) heavy silt loam; moderate, medium, prismatic structure parting to moderate, fine and very fine, subangular blocky; friable; few roots; common pores; thin clay films on faces of most peds and in pores and channels; slightly acid; gradual, wavy boundary.

B22t—22 to 30 inches, brown (10YR 4/3) heavy silt loam; moderate, fine and medium, prismatic structure parting to moderate, fine and very fine, subangular blocky; friable; few roots; common pores; thin clay films on faces of most peds and in pores and channels; slightly acid; clear, smooth boundary.

IIB3—30 to 33 inches, yellowish-brown (10YR 5/4) gravelly loam; weak, medium, subangular blocky structure; very friable; about 25 percent gravel, by volume, mostly dolomite fragments; strong effervescence; mildly alkaline; clear, wavy boundary.

IIC—33 to 60 inches, pale-brown (10YR 6/3) very gravelly sandy loam; massive; very friable; about 60 percent gravel, by volume, mostly dolomite fragments; violent effervescence; moderately alkaline; calcium carbonate equivalent is 85 percent.

The solum is 24 to 40 inches thick and overlies calcareous, very gravelly sandy loam till. The silty eolian mantle is 20 to 36 inches thick. The soil is dark colored to a depth of 10 to 16 inches. The A horizon is black, very dark brown, very dark gray, very dark grayish brown, or dark brown and is 10 to 14 inches thick. The B2t horizon is heavy silt loam or silty clay loam and is 12 to 30 inches thick. Coarse fragments, including dolomite cobbles and boulders, in the IIC horizon range from 30 to 60 percent, by volume. The calcium carbonate equivalent is 60 to 90 percent.

Mendota soils are near Markesan and Plano soils. They have a thicker mantle of silty eolian sediments and a thicker solum than Markesan soils. They have a thinner mantle of silty eolian sediments and a thinner solum than Plano soils.

MsA—Mendota silt loam, 0 to 2 percent slopes. This soil is nearly level and is on broad ridgetops and valley floors of the till plains. Areas are irregular in shape and cover 3 to 130 acres.

This soil has a surface layer that is about 4 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of gently sloping Mendota silt loam. In some small areas dolomite fragments are on the surface; underlying till is very gravelly loam; or till contains less than 30 percent gravel, by volume. And in places, dolomite is at a depth of 40 to 60 inches.

Runoff is slow. This soil has few limitations.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil can be cropped intensively where organic matter and tilth are maintained. Capability unit I–4; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

MsB—Mendota silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and valley floors of the till plains. Areas are elongated to irregular in shape and cover 3 to 200 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of nearly level or sloping and eroded or severely eroded Mendota silt loam. In some small areas dolomite fragments are on the surface and throughout the solum; the underlying till is very gravelly loam; the till contains less than 30 percent gravel, by volume; or dolomite is at a depth of 40 to 60 inches.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main conerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

MsC2—Mendota silt loam, 6 to 12 percent slopes,

eroded. This soil is sloping and is on side slopes of broad ridges on till plains. Most areas are elongated to irregular in shape and cover 3 to 30 acres.

This soil has a surface layer that is 1 to 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of gently sloping and uneroded or severely eroded Mendota silt loam. In small areas dolomite fragments are on the surface and throughout the surface layer and subsoil; the underlying till is very gravelly loam; or the till contains less than 30 percent gravel, by volume.

Runoff is medium, and the hazard of erosion is moderate.

With proper management this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

Oakville Series

The Oakville series consists of nearly level to steep, well-drained soils on outwash plains and terraces and in old glacial lake basins and of eolian sand deposits on till uplands. These soils are sandy and are underlain by sand. The native vegetation was dominantly deciduous forest.

In a representative profile the surface layer is dark grayish-brown fine sand about 7 inches thick. The subsoil is dark yellowish-brown, loose fine sand about 26 inches thick. The substratum is yellowish-brown, loose fine sand in the upper part; light yellowish-brown, loose fine sand in the middle part; and pale-brown, loose medium sand to a depth of about 60 inches.

The available water capacity is low, and permeability is very rapid. Natural fertility is low. The organic-matter content of the surface layer is low.

Most areas of nearly level and gently sloping soils are used for corn, small grains, legumes, and pasture and some are in woodland. Most areas of sloping to steep soils are used for pasture, woodland, or wildlife habitat. Some formerly cultivated areas are no longer being actively farmed.

Representative profile of Oakville fine sand, 1 to 6 percent slopes, approximately 40 feet south and 720 feet east of the northwest corner of the NE¼ sec. 3, T. 15 N., R. 11 E., in a cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) fine sand; very weak, fine, granular structure, single grained where disturbed; very friable; common roots; neutral; abrupt, smooth boundary.

B21—7 to 23 inches, dark yellowish-brown (10YR 4/4) fine sand; weak, fine and very fine, subangular blocky structure, single grained where disturbed; loose; few roots; neutral; clear, smooth boundary.

B22—23 to 33 inches, dark yellowish-brown (10YR 4/4) fine sand; single grained; loose; few roots; neutral; gradual, smooth boundary.

C1—33 to 37 inches, yellowish-brown (10YR 5/4) fine sand; single grained; loose; few roots; slightly acid; clear, smooth boundary.

C2—37 to 53 inches, light yellowish-brown (10YR 6/4) fine sand; single grained; loose; few roots; slightly acid; clear, smooth boundary.

C3—53 to 60 inches, pale-brown (10YR 6/3) medium sand; single grained; loose; medium acid.

Solum is 20 to 40 inches thick and averages between 50 and 90 percent fine sand and as much as 25 percent very fine sand. The Ap horizon is brown, dark grayish brown, or very dark grayish brown and is 6 to 10 inches thick. The B2 horizon is 10 to 30 inches thick.

Oakville soils are near Brems and Gotham soils. They lack the layer of clay accumulation characteristic of Gotham soils. Oakville soils are well drained, and Brems soils are moderately well drained.

OaB—Oakville fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces and in old glacial lake basins, and some areas are eolian sand deposits on till uplands. Areas are elongated to irregular in shape and cover 3 to 190 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Okee and Richford soils and of sloping and eroded Oakville fine sand. In some small areas this soil is severely eroded by soil blowing; is dominantly medium and coarse sand; or is underlain by loamy or clayey deposits, stratified sand and gravel, or gravelly sandy loam glacial till at a depth of 45 inches.

Runoff is slow. The hazard of erosion is slight. This soil is subject to soil blowing. The low available water capacity limits the crop yields during most seasons.

This soil is suited to irrigation. Most of the acreage is used for general farm crops. Some areas have been planted to pine trees. With fertilization, supplemental irrigation, and protection from soil blowing, this soil can be used for farm crops and certain vegetable crops. It is best to plant early in spring before the soil has a chance to dry. Later plantings, especially of small seeded crops, have a poor chance of survival. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVs–3; woodland group 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

OaC—Oakville fine sand, 6 to 12 percent slopes. This soil is sloping and is on outwash plains and terraces and in old glacial lake basins, and some areas are eolian sand deposits on till uplands. Areas of this soil are elongated and cover 3 to 50 acres.

This soil has a surface layer and subsoil that, combined, are 4 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Mecan, Okee, and Richford soils and small areas of gently sloping or moderately steep and eroded Oakville fine sand. In some small areas this soil is severely eroded by soil blowing; is dominantly medium and coarse sand; or is underlain by loamy or clayey deposits, stratified sand and gravel, or gravelly sandy loam glacial till at a depth of 45 inches.

Runoff is medium, and the hazard of erosion is slight. This soil is subject to soil blowing.

This soil is best suited to woodland or wildlife habitat. It is generally not suited to row crops because of low available water capacity and the hazard of soil blowing. Most of the cultivated acreage is used for pasture and hay. Many areas are in native woodland

and some have been planted to pine trees. Pasture and hay are best seeded early in spring before the soil has a chance to dry. Later plantings have a poor chance of survival. The main concerns of management are maintaining plant cover and reducing erosion and soil blowing. Capability unit VIs-3; woodland group 3s1; recreation group 2; wildlife group 3; tree and shrub group 2.

OaD—Oakville fine sand, 12 to 35 percent slopes. This soil is moderately steep to steep and is on outwash plains and terraces and in old glacial lake basins, and some areas are eolian sand deposits on till uplands. Areas are elongated and cover 3 to 20 acres.

This soil has a surface layer about 2 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer, Okee, and Richford soils and small areas of sloping, eroded, or severely eroded Oakville fine sand. In some places this soil is dominantly medium and coarse sand. Also included are some small areas where this soil is underlain by stratified sand and gravel or gravelly sandy loam glacial till at a depth of more than 45 inches.

Runoff is medium to rapid. The hazard of erosion is slight to severe. This soil is subject to soil blowing.

This soil is best suited to woodland or wildlife habitat. It is not suitable for cultivated crops because of the low available water capacity and hazards of erosion and soil blowing. Most of the acreage is in native woodland but some has been planted to pine trees. The main concerns of management are maintaining plant cover and reducing erosion and soil blowing. Capability unit VIIs–3; woodland group 3s3; recreation group 2; wildlife group 3; tree and shrub group 2.

Okee Series

The Okee series consists of nearly level to moderately steep, well drained and somewhat excessively drained soils on till plains, moraines, and valley floors. These soils are sandy and are underlain by gravelly sandy loam or gravelly loamy sand glacial till. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 9 inches thick (fig. 9). The subsurface layer is yellowish-brown, loamy fine sand about 16 inches thick. The subsoil is brown, friable sandy loam about 20 inches thick. The substratum is brown, friable, gravelly sandy loam to a depth of 60 inches.

The available water capacity is moderate, and permeability is moderate. Natural fertility is low. The organic-matter content of the surface layer is low.

Most areas of nearly level, gently sloping, and sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep soils are used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Okee loamy fine sand, 6 to 15 percent slopes, approximately 720 feet west and 100 feet south of the center of sec. 26, T. 16 N., R. 11 E., in a pine plantation:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine, granular structure; very friable; common roots; medium acid; abrupt, smooth boundary.

A2—9 to 25 inches, yellowish-brown (10YR 5/4) loamy fine sand; weak, fine, subangular blocky structure; very friable; few roots; medium acid; abrupt, smooth boundary.

IIB21t—25 to 31 inches, brown (7.2YR 4/4) heavy sandy loam; weak, fine and medium, subangular blocky structure; friable; few roots; common pores; thin clay films on faces of some peds and on pebbles; about 5 percent gravel, by volume; medium acid; clear, wavy boundary.

IIB22t—31 to 45 inches, brown (7.5YR 4/4) sandy loam; weak, fine, subangular blocky structure; friable; few roots; common pores; thin clay films on faces of peds and on pebbles; about 5 percent gravel, by volume; slightly acid; abrupt, wavy boundary.

IIC—45 to 60 inches, brown (7.5YR 5/4) gravelly sandy loam; massive; friable; common pores; about 15 percent gravel, by volume; strong effervescence; moderately alkaline.

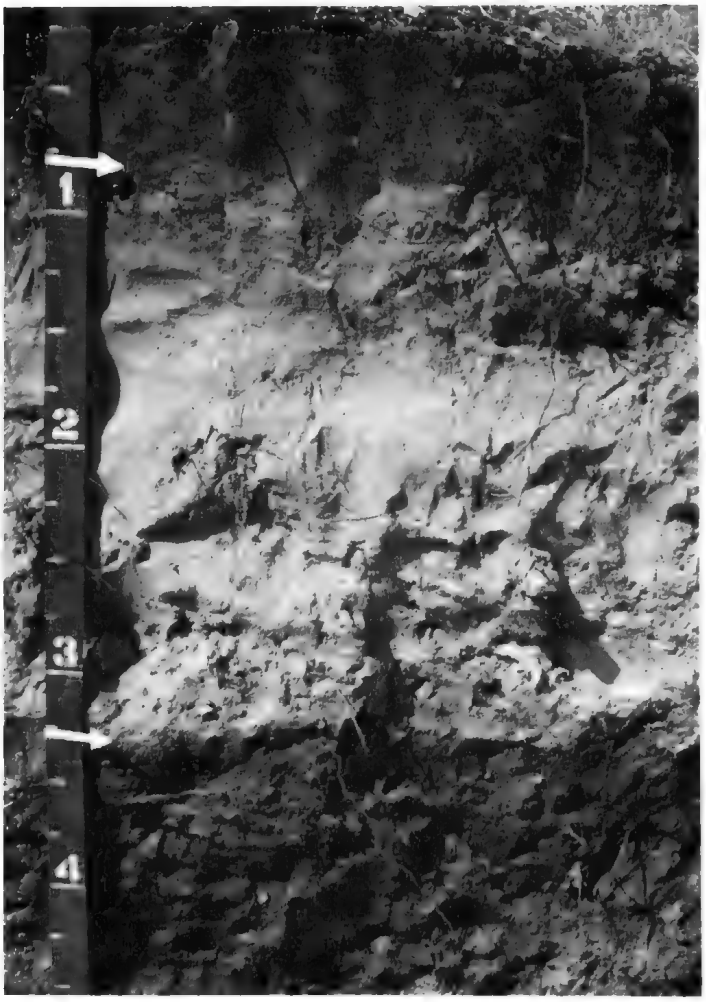

***Figure 9.*—Profile of Okee soil. About 33 inches of windblown sand covers the subsoil that formed in glacial till. Unweathered, sandy loam glacial till is at a depth of about 58 inches.**

The solum is 40 to 60 inches thick and overlies calcareous, gravelly sandy loam glacial till. The sandy mantle is 20 to 40 inches thick. The Ap or A1 horizon is very dark grayish brown, dark brown, or dark grayish brown and is 6 to 10 inches thick. The A2 horizon is fine sand or loamy fine sand

14 to 30 inches thick. The IIBt horizon is dominantly sandy loam but has thin layers of loam, clay loam, or sandy clay loam in places. It is 15 to 30 inches thick. Coarse fragments, including cobbles and boulders, in the IIC horizon range from 5 to about 25 percent, by volume.

Okee soils are near Grelton, Lapeer, and Mecan soils. They have a 20- to 40-inch thick sandy mantle which Grellton soils lack. They have a thicker sandy mantle than Lapeer and Mecan soils and a thicker solum than Lapeer soils.

OkB—Okee loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on broad ridgetops and valley floors of the till plains. Areas are irregular in shape and cover 3 to 200 acres.

This soil has a thicker sandy mantle and the combined surface layer and subsoil combined are thicker than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Grellton, Kidder, Mecan, and Oakville soils. Also included are small areas of sloping and eroded Okee loamy fine sand. In some places the sandy mantle is fine sand rather than loamy fine sand; the lower part of the subsoil is dominantly loam, clay loam, or sandy clay loam; the underlying till is gravelly loam or gravelly loamy sand; or this soil is underlain by silt loam deposits.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and certain vegetable crops. Most of the acreage is used for general farm crops but some is in native woodland. Some has been planted to pine trees. Fertilization, supplemental irrigation, and protection from soil blowing help insure dependable crop production. Planting early in spring, before the sandy upper layers have a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIs–4; woodland group 2s1; recreation group 2; wildlife group 1; tree and shrub group 1.

OkC—Okee loamy fine sand, 6 to 15 percent slopes. This soil is sloping and moderately steep and is on side slopes on till plains and moraines. Areas are irregular in shape and cover 3 to 60 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Grellton, Kidder, Lapeer, Mecan, and Oakville soils and small areas of gently sloping and eroded Okee loamy fine sand. In some places the sandy mantle is fine sand rather than loamy fine sand or the lower subsoil is dominantly loam, clay loam, or sandy clay loam. Also included are places where the underlying till is gravelly loam or gravelly loamy sand or this soil is underlain by silt loam deposits.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing.

Where managed properly, this soil is suitable for all the farm crops commonly grown in the county. Most of the acreage is used for general farm crops and some is in native woodland. Some has been planted to pine trees. Planting early in spring, before the sandy upper layers have a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe–7; woodland group 2s1; recreation group 2; wildlife group 1; tree and shrub group 1.

Oshtemo Series

The Oshtemo series consists of nearly level to sloping, well-drained soils on outwash plains and terraces. These soils have a sandy and loamy subsoil underlain by sand or stratified sand and gravel outwash. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 8 inches thick. The subsoil is about 54 inches thick. It is dark yellowish-brown, very friable loamy fine sand in the upper part; brown, friable sandy loam in the middle part; and brown and dark yellowish-brown, very friable loamy sand in the lower part. The substratum is brown, loose sand to a depth of 80 inches.

The available water capacity is moderate, and permeability is moderately rapid. Natural fertility is medium. The organic-matter content of the surface layer is low.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. A few areas are in native woodland.

Representative profile of Oshtemo loamy fine sand, 1 to 6 percent slopes, approximately 200 feet north and 400 feet west of the center of sec. 5, T. 15 N., R. 12 E., in a cultivated field:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loamy fine sand; very weak, medium, subangular blocky structure; very friable; common roots; common pores; neutral; abrupt, smooth boundary.

B1—8 to 14 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; very weak, medium, subangular blocky structure; very friable; common roots; common pores; some dark grayish-brown (10YR 4/2) soil material in old root channels; neutral; clear, smooth boundary.

B2t—14 to 30 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; common roots; common pores; clay bridging between sand grains; neutral; gradual, irregular boundary.

B31—30 to 40 inches, brown (7.5YR 4/4) loamy sand; weak, medium, subangular blocky structure; very friable; few roots; common pores; clay bridging between some sand grains; medium acid; clear, wavy boundary.

B32—40 to 50 inches, brown (7.5 YR 4/4) loamy sand; weak, medium, platy structure parting to weak, fine, subangular blocky; very friable; common pores; clay bridging between some sand grains; medium acid; gradual, wavy boundary.

B33—50 to 62 inches, dark yellowish-brown (10YR 4/4) loamy sand; weak, coarse, subangular blocky structure; very friable; common pores; clay bridging between some sand grains; slightly acid; gradual, wavy boundary.

C—62 to 80 inches, brown (10YR 5/3) sand; single grained; loose; slightly acid.

The solum is 40 to 66 inches thick and overlies sand or stratified sand and gravel. The Ap horizon is brown, dark brown, dark yellowish brown, or dark grayish brown and is 6 to 9 inches thick. The B2t horizon is dominantly sandy

loam but has thin layers of sandy clay loam in some places. It is 15 to 35 inches thick. The B3 horizon is loamy sand or sand 15 to 35 inches thick. Gravel content of the B3 horizon is as much as 25 percent, by volume. In some places there is a thin horizon of clay accumulation directly above the C horizon. The C horizon is dominantly medium and coarse sand but in some places it is stratified sand and gravel.

Oshtemo soils are near Boyer and Richford soils. They have a thicker solum than Boyer soils. They have more clay in the B horizon than Richford soils and have a thinner sandy mantle.

OmB—Oshtemo loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces. Most areas are elongated and cover 3 to 200 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Gotham, Oakville, and Richford soils and small areas of sloping and eroded Oshtemo loamy fine sand. In some places the surface layer is fine sandy loam or fine sand. Also included are some small areas that are underlain by gravelly sandy loam till or stratified silt and fine sand.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing.

This soil is suited to irrigation. Where managed properly, it is suited to all the farm crops commonly grown in the county and certain vegetable crops. Most of the acreage is used for general farm crops but some is in native woodland. Some has been planted to pine trees. Fertilization, supplemental irrigation, and protection from soil blowing help insure dependable crop production. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIs–4; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 2.

OmC2—Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded. This soil is sloping and is on low ridges and knobs and along drainageways of the outwash plains and terraces. Areas are irregular in shape and cover 3 to 40 acres.

This soil has a surface layer that is about 3 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Gotham, Oakville, and Richford soils and small areas of gently sloping and uneroded Oshtemo loamy fine sand. In some areas slopes are as much as 20 percent or the surface layer is fine sandy loam or fine sand. Also included are some small areas that are underlain by gravelly sandy loam till or stratified silt and fine sand.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing.

Where managed properly, this soil is suitable for all of the farm crops commonly grown in the county. Most of the acreage is used for general farm crops and some is in native woodland. Some areas of this soil have been planted to pine trees. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe–7; woodland group 3o1; recreation group 2; wildlife group 1; tree and shrub group 2.

Ossian Series

The Ossian series consists of nearly level, poorly drained soils on flood plains and in old glacial lake basins, drainageways, and depressions on till plains. These soils are loamy and are underlain by silt loam deposits. The native vegetation was mainly marsh grasses, reeds, and sedges. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is about 18 inches thick and has strong-brown mottles. It is black silt loam in the upper part and very dark gray silt loam in the lower part. The subsoil is about 27 inches thick and has strong-brown and yellowish-brown mottles. It is olive-gray, friable silt loam in the upper part and light olive-gray, very friable silt loam in the lower part. The substratum is light olive gray, very friable silt loam to a depth of 60 inches. It has yellowish-brown and olive-yellow mottles.

The available water capacity is very high, and permeability is moderate. The depth of root penetration is limited by the water table. Natural fertility is high. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wetland wildlife habitat, and some are used for unimproved pasture.

Representative profile of Ossian silt loam approximately 250 feet east and 250 feet south of the northwest corner of the NE¼ of sec. 24, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, black (N 2/0) silt loam; weak, fine, granular structure; very friable; few roots; few pores; light gray (5Y 7/2), when dry, silt coatings on faces of a few peds and filling some pores and channels; neutral; abrupt, smooth boundary.

A12—7 to 15 inches, black (N 2/0) silt loam; common, fine and medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, fine, subangular blocky structure; very friable; few roots; few pores; light gray (5Y 7/2), when dry, silt coatings on faces of a few peds and filling some pores and channels; neutral; clear, smooth boundary.

A3—15 to 18 inches, very dark gray (10YR 3/1) silt loam; few, fine, prominent, strong-brown (7.5YR 5/6) mottles; moderate, medium and fine, subangular blocky structure; very friable; few roots; few pores; light gray (5Y 7/2), when dry, silt coatings on faces of a few peds and filling some pores and channels; some black (N 2/0) soil material filling old worm and root channels; neutral; abrupt, smooth boundary.

B2g—18 to 30 inches, olive-gray (5Y 5/2) silt loam; moderate, medium, prismatic structure parting to moderate, very fine, subangular blocky; friable; few roots; common pores; thin, discontinuous clay films on faces of a few peds and in a few pores and channels; very dark gray (10YR 3/1) coatings on faces of many peds and filling pores and channels; neutral; gradual, smooth boundary.

B3g—30 to 45 inches, light olive-gray (5Y 6/2) silt loam; common, fine, prominent, strong-brown (7.5YR 5/6) and yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; very friable; common pores; very dark gray (10YR 3/1) coatings on faces of some peds and in pores and channels; slight effervescence; mildly alkaline; gradual, wavy boundary.

C—45 to 60 inches, light olive-gray (5Y 6/2) silt loam; many, fine and medium, prominent, yellowish-

brown (10YR 5/6) and olive-yellow (2.5Y 6/6) mottles; massive; very friable; strong effervescence; moderately alkaline; gradual, wavy boundary.

The solum is 24 to 48 inches thick. Depth to carbonates is 40 to 60 inches. The silty mantle is 40 to 96 inches thick. The dark-colored A horizon is 10 to 24 inches thick. It is black, very dark brown, very dark gray, or very dark grayish brown. The C horizon is silt loam, gravelly sandy loam, or stratified silt, fine sand, and very fine sand.

Ossian soils are near Joy and Plano soils. Ossian soils are poorly drained, Joy soils are somewhat poorly drained, and Plano soils are well drained and moderately well drained.

Os—Ossian silt loam. This soil is nearly level and is on flood plains and in old glacial lake basins, drainageways, and depressions on till plains. Areas are elongated to irregular in shape and cover 3 to 260 acres.

Included with this soil in mapping are small areas of Joy and Palms soils. In some small areas the surface layer is silty clay loam or loam or is muck as much as 16 inches thick; or this soil is underlain by sand, stratified sand and gravel, or gravelly sandy loam till. In drainageways and depressions the surface layer is thicker than is typical and there is as much as 40 inches of silt loam overwash.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Where properly managed, this soil is suitable for certain vegetable crops. Where drained, acreage is used for most of the farm crops commonly grown in the county. Undrained areas are used for wetland wildlife habitat and some are used for unimproved pasture. Capability unit IIw–1; woodland group 3w2; recreation group 7; wildlife group 7; tree and shrub group 3.

Palms Series

The Palms series consists of nearly level, very poorly drained soils on flood plains and in drainageways, depressions, and old glacial lake basins. These soils are organic and are underlain by loamy material. The native vegetation was a marsh type consisting of sedges, reeds, and grasses; shrubs such as willow, alder, aspen, and dogwood; and trees such as tamaracks. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black, nonsticky muck about 26 inches thick. The content of plant fibers decreases in the lower part. The substratum is very dark gray, dark-gray, and light brownish-gray, firm clay loam in the upper part; light brownish-gray, friable sandy loam in the middle part; and reddish-brown, firm silty clay loam to a depth of 60 inches. The lower part of the substratum has light-gray mottles.

The available water capacity is very high. Permeability is rapid in the organic layer and moderate in the substratum. The depth of root penetration is limited by the water table. Natural fertility is low.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat, and some are used for unimproved pasture.

Representative profile of Palms muck, approximately 530 feet south and 920 feet east of the northwest corner of the SW¼ of sec. 20, T. 15 N., R. 12 E., in an uncultivated wetland:

Oa1—0 to 8 inches, black (N 2/0, broken face and rubbed) sapric material; about 10 percent fiber, less than 5 percent rubbed; weak, fine, crumb structure; nonsticky; mainly herbaceous fibers; few rounded quartz grains; neutral; abrupt, smooth boundary.

Oa2—8 to 16 inches, black (N 2/0, broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; weak, thick, platy structure parting to weak, fine and medium, crumb; nonsticky; mainly herbaceous fibers; few rounded quartz grains; neutral; gradual, smooth boundary.

Oa3—16 to 20 inches, black (N 2/0, broken face and rubbed) sapric material; a trace of fiber, none rubbed; weak, fine and medium, crumb structure; nonsticky; mainly herbaceous fibers; few rounded quartz grains; neutral; clear, smooth boundary.

Oa4—20 to 26 inches, black (N 2/0, broken face), black (10YR 2/1, rubbed) sapric material; a trace of fiber, none rubbed; massive; nonsticky; mainly herbaceous fibers; a few thin layers of sand less than ¼ inch thick; about 15 percent mineral matter, by volume, mostly quartz grains; mildly alkaline; abrupt, smooth boundary.

IIC1g—26 to 30 inches, very dark gray (5Y 3/1) clay loam; massive; firm; mildly alkaline; clear, smooth boundary.

IIC2g—30 to 41 inches, mixed dark-gray (10YR 4/1) and light brownish-gray (2.5Y 6/2) clay loam; massive; firm; mildly alkaline; clear, smooth boundary.

IIIC3—41 to 48 inches, light brownish-gray (2.5Y 6/2) sandy loam; massive; friable; mildly alkaline; abrupt, smooth boundary.

IVC4—48 to 60 inches, reddish-brown (5YR 5/3) light silty clay loam; common, medium, prominent, light-gray (5Y 7/1) mottles; massive; firm; violent effervescence; mildly alkaline.

The organic layer is 16 to 50 inches thick. The organic part of the subsurface and bottom tiers is mainly sapric material. Some places, however, have thin layers of hemic material that, combined, are less than 10 inches thick. The organic part is mainly herbaceous plant material, but a few woody fragments ranging from ⅛ inch to several inches in diameter are mixed throughout the organic part in some places. The C horizon in most places is stratified sandy loam, loam, silt loam, silty clay loam, or clay loam.

Palms soils are near Adrian, Barry, and Houghton soils. Palms soils are underlain by loamy material, and Adrian soils by fine sand. Palm soils have a 16- to 50-inch organic layer which Barry soils lack, and Houghton soils have an organic layer that is more than 50 inches thick.

Pa—Palms muck. This soil is nearly level and is on flood plains and in drainageways, depressions, and old glacial lake basins. Areas are elongated to irregular in shape and cover 3 to 160 acres. Many areas of this soil are between areas of Houghton soils and the surrounding mineral soils.

Included with this soil in mapping are small areas of Adrian, Houghton, and Willette soils. In small areas the organic layer is less than 16 inches thick; there is as much as 16 inches of sandy or loamy overwash; or the substratum is gravelly sandy loam glacial till.

Runoff is very slow. This soil is likely to be ponded during wet seasons and after heavy rains. Cultivated areas are subject to soil blowing and burning. In such areas, excessive lowering of the water table causes the organic matter to decompose very rapidly, and subsidence also becomes a problem. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Where drained, this soil is suitable for certain vegetable crops such as lettuce, beets, and carrots. Where drained, the acreage is used for corn. Undrained areas are used for wetland wildlife habitat and some are used for unimproved pasture. Capability unit IIw–8; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

Plano Series

The Plano series consists of nearly level and gently sloping, well drained and moderately well drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was prairie grasses. Some areas are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is black silt loam about 11 inches thick. The subsoil is about 47 inches thick. It is brown, friable silt loam in the upper part; brown and dark yellowish-brown, firm silty clay loam and silt loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is brown, friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is very high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other farm crops commonly grown in the county. Canning crops such as peas and sweet corn are also grown.

Representative profile of Plano silt loam, 2 to 6 percent slopes, approximately 100 feet south and 1,250 feet west of the northeast corner of sec. 26, T. 15 N., R. 12 E., in a cultivated field:

Ap—0 to 8 inches, black (10YR 2/1) silt loam; weak, medium, subangular blocky structure; very friable; few roots; many pores; neutral; abrupt, smooth boundary.

A12—8 to 11 inches, black (10YR 2/1) silt loam; weak, medium, platy structure parting to weak, very fine, subangular blocky; very friable; few roots; common pores; some brown (10YR 4/3) subsoil in old worm casts; slightly acid; clear, smooth boundary.

B21t—11 to 25 inches, brown (10YR 4/3) heavy silt loam; moderate, fine and medium, subangular blocky structure; friable; few roots; many pores; some black (10YR 2/1) soil material in old worm and root channels; thin discontinuous clay films on faces of most peds; slightly acid; gradual, wavy boundary.

B22t—25 to 41 inches, brown (10YR 4/3) light silty clay loam; moderate, fine and medium, subangular blocky structure; firm; few roots; many pores; thin discontinuous clay films on faces of most peds; medium acid; clear, wavy boundary.

B23t—41 to 54 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; weak, medium, prismatic structure parting to weak, medium, subangular blocky; firm; few roots; many pores; thin discontinuous clay films on faces of peds; medium acid; clear, wavy boundary.

IIB3t—54 to 58 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; few roots; many pores; thin discontinuous clay films on faces of some peds; about 10 percent gravel, by volume; neutral; clear, smooth boundary.

IIC—58 to 60 inches, brown (7.5YR 5/4) gravelly sandy loam; massive; friable; many pores; about 15 percent gravel, by volume; strong effervescence; moderately alkaline.

The solum is 45 to 70 inches thick and overlies calcareous, gravelly sandy loam till. The silty eolian mantle is 50 to 60 inches thick. The soil is dark colored to a depth of 10 to 24 inches. The A horizon is very dark gray, very dark grayish brown, very dark brown or black and is 10 to 18 inches thick. The B2t horizon is silt loam or silty clay loam 24 to 50 inches thick. The IIB3t horizon is loam, sandy clay loam, or sandy loam 3 to 10 inches thick. In some places the soil is mottled below a depth of about 36 inches. Coarse fragments, including stones and boulders, in the IIC horizon range from 5 to about 25 percent, by volume.

Plano soils are near Friesland and Mendota soils. They have a thicker silty eolian mantle and thicker solum than Mendota soils. They have less sand in the A horizon and upper part of the B horizon than Friesland soils.

PnA—Plano silt loam, 0 to 2 percent slopes. This soil is nearly level and is on broad ridgetops and valley floors of the till plains. Areas are round or oblong in shape and cover 3 to more than 500 acres.

This soil has a surface layer 4 to 6 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Joy soils, small areas of gently sloping Plano silt loam, and small areas that have dolomite fragments on the surface and throughout the surface layer and subsoil. In drainageways and depressions the surface layer is thicker than in the representative soil and there is as much as 40 inches of silt loam overwash. In some places the content of coarse fragments in the substratum is as much as 60 percent, by volume, and in these areas the coarse fragments are mostly angular dolomite. And in places, dolomite bedrock is at a depth of 36 to 60 inches.

Runoff is slow. This soil has few limitations.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. It can be cropped intensively if management includes regular additions of organic matter and maintaining tilth. Capability unit I–4; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

PnB—Plano silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and valley floors of the till plains. Areas are irregular in shape and cover 3 to 130 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Joy soils and small areas of nearly level and eroded Plano silt loam. Some places have slopes of as much as 11 percent. In drainageways and depressions the surface layer is thicker than in the representative soil and there is as much as 40 inches of silt loam overwash. Some small areas have dolomite fragments on the surface and throughout the surface layer and subsoil. In some places the content of coarse fragments in the substratum is as much as 60 percent, by volume, and in these areas the coarse fragments are mostly angular dolomite. In places, dolomite bedrock is at a depth of 36 to 60 inches. Small round depressions in this soil are sinkholes that formed in the dolomite.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of manage-

ment are maintaining organic-matter content, conserving moisture, reducing runoff, improving tilth, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

Poy Series

The Poy series consists of nearly level, poorly drained soils in old glacial lake basins. These soils have a clayey subsoil underlain by sand. The native vegetation was mainly marsh grasses, shrubs, and some trees such as bur oak, soft maple, and elm. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is about 12 inches thick. It is black silty clay loam in the upper part and black silty clay in the lower part. The subsoil is about 24 inches thick and has yellowish-brown, reddish-brown, and yellow mottles. It is dark-gray firm clay in the upper part; gray firm clay in the middle part; and mixed gray and reddish-brown, firm silty clay in the lower part. The substratum is light gray, loose, fine sand to a depth of 60 inches. It has yellowish-brown mottles.

The available water capacity is moderate. Permeability is slow in the subsoil and rapid in the substratum. Depth of the root zone is limited by the water table. Natural fertility is medium. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat, and some areas are used for unimproved pasture.

Representative profile of Poy silty clay loam, approximately 680 feet south and 1,300 feet east of the northwest corner of the NE¼ of sec. 11, T. 17 N., R. 13 E., in a formerly cultivated field now in pasture:

Ap—0 to 6 inches, black (N 2/0) silty clay loam; weak, medium and fine, subangular blocky structure; friable; common roots; common pores; moderately alkaline; abrupt, smooth boundary.

A12—6 to 12 inches, black (10YR 2/1) silty clay; weak, fine and very fine, subangular blocky structure; firm; few roots; common pores; moderately alkaline; clear, smooth boundary.

B21g—12 to 22 inches, dark-gray (5Y 4/1) clay; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; moderate, fine and very fine, angular blocky structure; firm; few roots; common pores; slight effervescence; moderately alkaline; gradual, smooth boundary.

B22g—22 to 30 inches, gray (5Y 5/1) clay; many, fine, prominent, reddish-brown (5YR 4/4) mottles; moderate, fine and very fine, angular blocky structure; firm; few roots; common pores; slight effervescence; moderately alkaline; gradual smooth boundary.

B3—30 to 36 inches, mixed gray (5Y 6/1) and reddish-brown (5YR 4/4) silty clay; common, medium, prominent, yellow (10YR 7/6) mottles; moderate, medium, angular blocky structure; firm; few pores; slight effervescence; moderately alkaline; abrupt, smooth boundary.

IIC—36 to 60 inches, light-gray (5Y 7/1) fine sand; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; single grained; loose; some olive-gray (5Y 4/2) sand and plant fibers in the upper few inches of this horizon; moderately alkaline.

The solum is 20 to 40 inches thick, and free carbonates are at a depth of 10 to 20 inches. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 10 to 15 inches thick. The B2g horizon is clay or silty clay 10 to 32 inches thick.

Poy soils are near Poygan, Willette, and Zittau soils. Poy soils are underlain by sand and Poygan soils by clayey deposits. Poy soils lack the 16– to 50–inch organic layer of Willette soils. Poy soils are poorly drained, and Zittau soils are somewhat poorly drained.

Pr—Poy silty clay loam. This soil is nearly level and is in old glacial lake basins. Areas are irregular in shape and cover 3 to 500 acres.

Included with this soil in mapping are small areas of Granby, Poygan, and Willette soils. In some small areas the surface layer is silt loam or loam or it is organic and is as much as 16 inches thick. Thin sandy or loamy strata are in the subsoil in places, or loamy or clayey strata are in the substratum.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Where tiles are set in the underlying sand, care must be taken to prevent loose sand from entering the tile lines.

Undrained areas are suitable for wetland wildlife habitat. Some undrained areas are used for unimproved pasture. Where drained, most of the acreage is used for corn. Capability unit IIw–5; woodland group 2w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Poygan Series

The Poygan series consists of nearly level, poorly drained soils in old glacial lake basins. These soils have a clayey subsoil underlain by clayey lacustrine deposits. The native vegetation was mainly marsh grasses and some trees such as elm and soft maple. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the surface layer is about 12 inches thick. It is black silty clay loam in the upper part and black silty clay in the lower part. The subsoil is about 20 inches thick and has grayish-brown, reddish-brown, and gray mottles. It is gray, firm clay in the upper part and brown, firm clay in the lower part. The substratum is reddish-brown, massive, silty clay to a depth of 60 inches. The upper part of the substratum has light-gray mottles.

The available water capacity is moderate, and permeability is slow. The depth of root penetration is limited by the water table. Natural fertility is medium. The organic-matter content of the surface layer is very high.

Where drained, most of the acreage is used for corn, small grains, and legumes. Undrained soils provide good wetland wildlife habitat, and some areas are used for unimproved pasture.

Representative profile of Poygan silty clay loam, approximately 500 feet west and 550 feet south of the northeast corner of sec. 1, T. 17 N., R. 13 E., in a formerly cultivated field now in pasture:

Ap—0 to 8 inches, black (N 2/0) silty clay loam; weak, very fine, subangular blocky structure; friable; common roots; common pores; mildly alkaline; abrupt, smooth boundary.

A12—8 to 12 inches, black (10YR 2/1) silty clay; weak, very fine, subangular blocky structure; firm; few roots; common pores; mildly alkaline; abrupt, smooth boundary.

B21g—12 to 18 inches, gray (5Y 5/1) clay; common, medium, faint, grayish-brown (2.5Y 5/2) mottles and few, medium, prominent, reddish-brown (5YR 5/3) mottles; moderate, very fine, subangular blocky structure; firm; few roots; common pores; some black (10YR 2/1) soil material in old worm and root channels and on faces of some peds; mildly alkaline; clear, smooth boundary.

B22g—18 to 32 inches, brown (7.5YR 5/2) clay; common, fine, prominent, gray (5Y 5/1) mottles; moderate, very fine, angular blocky structure; firm; few roots; common pores; some black (10YR 2/1) soil material in old worm and root channels and on faces of some peds; mildly alkaline; clear, smooth boundary.

C1—32 to 47 inches, reddish-brown (5YR 5/3) silty clay; common, fine, prominent, light-gray (5Y 6/1) mottles; massive; firm; few pores; slight effervescence; moderately alkaline; gradual, smooth boundary.

C2—47 to 60 inches, reddish-brown (5YR 4/3) silty clay; massive; firm; few pores; slight effervescence; moderately alkaline.

The solum is 20 to 36 inches thick, and free carbonates are at a depth of 20 to 36 inches. The dark-colored A horizon is 10 to 18 inches thick. The Ap horizon is black or very dark gray and is 6 to 9 inches thick. The A12 horizon is black or very dark gray silty clay loam or silty clay 4 to 9 inches thick. The B2g horizon is clay or silty clay 8 to 24 inches thick. The C horizon is clay or silty clay.

Most areas of these soils have a dark-colored A horizon that is thicker than is defined as the range for the series. This difference does not alter the usefulness and behavior of the soils.

Poygan soils are near Manawa, Poy, and Willette soils. Poygan soils are poorly drained, and Manawa soils are somewhat poorly drained. Poygan soils lack the sandy C horizon characteristics of Poy soils and the 16- to 50- inch organic layer characteristic of Willette soils.

Py—Poygan silty clay loam. This soil is nearly level and is in old glacial lake basins. Areas are irregular in shape and are mostly 3 to 130 acres in size, but one area exceeds 1,200 acres.

Included with this soil in mapping are small areas of Manawa, Poy, and Willette soils. In some small areas the surface layer is silt loam or loam, or it is organic and is as much as 16 inches thick.

Runoff is very slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to dispose of excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage.

Undrained areas are suitable for wetland wildlife habitat. Where drained, most of the acreage is used for corn, small grains, and legumes. Some undrained areas are used for unimproved pasture. Capability unit IIw-1; woodland group 2w1; recreation group 7; wildlife group 7; tree and shrub group 3.

Richford Series

The Richford series consists of nearly level to moderately steep, well drained and somewhat excessively drained soils on outwash plains and terraces and areas of eolian sand deposits on till uplands. These are sandy soils that are loamy in the lower part of the subsoil and are underlain by sand or fine sand. The native vegetation was deciduous forest.

In a representative profile the surface layer is very dark grayish-brown loamy sand about 9 inches thick. The subsoil is about 35 inches thick. It is brown, very friable loamy sand in the upper part; brown, friable sandy loam in the middle part; and brown, very friable loamy sand in the lower part. The substratum is brown, loose fine sand in the upper part and yellowish-brown, loose fine sand to a depth of 60 inches.

The available water capacity is low, and permeability is moderately rapid. Natural fertility is low.

Most areas of nearly level to sloping soils are used for corn, small grains, legumes, and pasture. Most areas of moderately steep soils are used for pasture, woodland, or wildlife habitat. Some areas which were once farmed are no longer being actively farmed, and some have been planted to pine trees.

Representative profile of Richford loamy sand, 1 to 6 percent slopes, approximately 140 feet north and 1,190 feet west of the southeast corner of the NE¼ of sec. 1, T. 14 N., R. 11 E., in a cultivated field:

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) loamy sand; weak, medium, granular structure; very friable; common roots; many pores; slightly acid; abrupt, smooth boundary.

B1—9 to 29 inches, brown (7.5YR 5/4) loamy sand; very weak, fine, subangular blocky structure, single grained where disturbed; very friable; few roots; many pores; slightly acid; abrupt, smooth boundary.

IIB2t—29 to 37 inches, brown (7.5YR 4/4) heavy sandy loam; weak, medium, subangular blocky structure; friable; few roots; many pores; thin discontinuous clay films on faces of peds; about 5 percent gravel, by volume; medium acid; clear, smooth boundary.

IIIB3t—37 to 44 inches, brown (7.5YR 4/4) light loamy sand; very weak, medium, subangular blocky structure, single grained where disturbed; very friable; few roots; many pores; medium acid; gradual, wavy boundary.

IIIC1—44 to 49 inches, brown (10YR 5/3) fine sand; single grained; loose; neutral; gradual, smooth boundary.

IIIC2—49 to 60 inches, yellowish-brown (10YR 5/4) fine sand; single grained; loose; neutral.

The solum is 30 to 50 inches thick. The sandy mantle is 20 to 36 inches thick. The Ap horizon is very dark grayish brown, dark grayish brown, or brown and is 6 to 9 inches thick. The B1 horizon is sand, fine sand, loamy sand, or loamy fine sand 14 to 30 inches thick. The IIB2t horizon is 6 to 10 inches thick. Gravel content ranges from 1 to about 7 percent. The IIIB3t horizon is light sandy loam or loamy sand 5 to 10 inches thick. The IIIC horizon is sand or fine sand.

Richford soils are near Gotham and Oshtemo soils. They have more clay in part of the B horizon than Gotham soils. They contain more sand than Oshtemo soils.

RaB—Richford loamy sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on outwash plains and terraces and in areas of sandy eolian deposits on till uplands. Areas are elongated to irregular in shape and cover 3 to 65 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Brems, Gotham, and Oakville soils and small areas of sloping or eroded Richford loamy sand. In some small areas, this soil is severely eroded by soil blowing; the lower part of the subsoil is silt loam, loam, sandy clay loam, or clay loam; or the underlying material is stratified sand and gravel or gravelly sandy loam till. In some places the surface layer is sand or fine sand.

Runoff is slow, and the hazard of erosion is slight. This soil is subject to soil blowing. It has a low avail-

able water capacity that limits crop yields during most seasons. Planting early in spring, before the soil has a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival.

This soil is suited to irrigation. Most of the acreage is used for general farm crops. Some has been planted to pine trees. With fertilization, supplemental irrigation, and protection from soil blowing, this soil can be used for farm crops and certain vegetable crops. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIs–4; woodland group 3o1; recreation group 2; wildlife group 3; tree and shrub group 2.

RaC—Richford loamy sand, 6 to 15 percent slopes. This soil is sloping and moderately steep and is on outwash plains and terraces and in areas of sandy eolian deposits on till uplands. Areas are elongated to irregular in shape and cover 3 to 30 acres.

This soil has a surface layer which is lighter colored and about 2 inches thinner than that of the soil described as representative of the series, and the surface layer and subsoil combined are about 6 inches thinner.

Included with this soil in mapping are small areas of Gotham, Oakville, and Mecan soils and small areas of gently sloping and eroded Richford loamy sand. In some areas slopes are up to 20 percent; small areas are severely eroded by soil blowing; the surface layer is sand or fine sand; the lower part of the subsoil is silt loam, loam, sandy clay loam, or clay loam; or the substratum is stratified sand and gravel or gravelly sandy loam till.

Runoff is medium, and the hazard of erosion is moderate. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Planting early in spring, before the soil has a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival.

Where managed properly, this soil is suited to most farm crops commonly grown in the county. Most of the acreage is used for general farm crops. Some is in native woodland, and some has been planted to pine trees. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIe–7; woodland group 3o1; recreation group 2; wildlife group 3; tree and shrub group 2.

Ripon Series

The Ripon series consists of nearly level and gently sloping, well-drained soils on broad ridgetops and side slopes. These soils are loamy and are underlain by dolomite bedrock. The native vegetation was prairie grasses.

In a representative profile the surface layer is about 11 inches thick. It is black silt loam in the upper part and very dark grayish-brown silt loam in the lower part. The subsoil is about 23 inches thick. It is brown, friable silt loam in the upper part; brown, firm silty clay loam in the middle part; and dark-brown, firm clay loam in the lower part. Pale-yellow creviced dolomite bedrock is at a depth of about 34 inches.

The available water capacity is moderate, and permeability is moderate. The depth of root penetration is limited by dolomite, but some roots extend into crevices which are filled with subsoil material. Natural fertility is high. The organic-matter content of the surface layer is moderate to high.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of Ripon silt loam, 1 to 6 percent slopes, approximately 600 feet north and 1,050 feet east of the center of sec. 30, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 9 inches, black (10YR 2/1) silt loam, weak, fine and very fine, granular structure; very friable; few roots; few pores; mildly alkaline; abrupt, smooth boundary.

A12—9 to 11 inches, very dark grayish-brown (10YR 3/2) silt loam; weak, fine and very fine, granular structure; very friable; few roots; few pores; many very dark gray (10YR 3/1) and few yellowish-brown (10YR 5/4) earthworm casts; neutral; clear, smooth boundary.

B21t—11 to 23 inches, brown (10YR 4/3) silt loam; moderate, fine and medium, subangular blocky structure; friable; few roots; common pores; thin patchy clay films on faces of some peds and in pores and channels; medium acid; gradual, wavy boundary.

B22t—23 to 32 inches, brown (10YR 4/3) silty clay loam; moderate, medium, subangular blocky structure; firm; few roots; common pores; thin patchy clay films on faces of some peds and in pores and channels; medium acid; abrupt, smooth boundary.

IIB23t—32 to 34 inches, dark-brown (10YR 4/3) clay loam; moderate, medium, subangular blocky structure; firm; few roots; few pores; thin patchy clay films on faces of most peds and in pores and channels; about 5 percent, by volume, is gravel of mixed origin; moderately alkaline; abrupt, irregular boundary.

IIIR—34 inches, pale-yellow (5Y 7/3) creviced dolomite bedrock.

The solum is 20 to 40 inches thick and overlies dolomite. The silty eolian mantle is 20 to 36 inches thick. The soil is dark colored to a depth of 10 to 20 inches. In some places, the dark color extends into the upper part of the B horizon. The A horizon is black, very dark brown, very dark gray, very dark grayish brown, or dark brown and is 10 to 20 inches thick. The B2t horizon is silt loam or silty clay loam 9 to 24 inches thick. The IIB23t horizon is loam or clay loam 1 to 6 inches thick. The IIIR horizon is creviced, and material from the IIB horizon fills these crevices in most places.

Ripon soils are near Knowles and Ritchey soils. They have a darker colored or thicker, dark-colored A horizon than Knowles or Ritchey soils. They are deeper to dolomite than Ritchey soils.

ReB—Ripon silt loam, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is on broad ridgetops and upper side slopes where the depth to dolomite is relatively shallow. Most areas are elongated and cover 3 to 40 acres.

Included with this soil in mapping are small areas of Lomira, Markesan, Mendota, and Ritchey soils. Also included are small areas of eroded Ripon silt loam. In some small areas slopes are as much as 11 percent. In some places the depth to dolomite is 40 to 60 inches and the silty eolian mantle is as much as 46 inches thick.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, improving tilth, reducing runoff,

and controlling erosion. Capability unit IIe–2; woodland group not assigned; recreation group 4; wildlife group 5; tree and shrub group 1.

Ritchey Series

The Ritchey series consists of gently sloping to very steep, well-drained soils on ridgetops and side slopes in areas where bedrock is near the surface. These soils are loamy and are underlain by dolomite bedrock. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is very dark grayish-brown silt loam about 4 inches thick. The subsoil is about 15 inches thick. It is brown, friable silt loam in the upper part; dark-brown, firm silty clay loam in the middle part; and dark-brown, firm gravelly clay loam in the lower part. Light brownish-gray, creviced dolomite is at a depth of 19 inches.

The available water capacity is low, and permeability is moderate. The depth of root penetration is limited by dolomite, but some roots extend into crevices which are filled with subsoil material. Natural fertility is medium. The organic-matter content of the surface layer is moderately low to moderate.

Most areas of gently sloping and sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep soils are used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Ritchey silt loam, 12 to 20 percent slopes, eroded, approximately 1,320 feet east and 1,000 feet south of the center of sec. 29, T. 15 N., R. 13 E., taken from an uneroded part of a cultivated field now idle:

Ap—0 to 4 inches; very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; very friable; many roots; few pores; neutral; clear, smooth boundary.

B1—4 to 8 inches, brown (10YR 4/3) heavy silt loam; moderate, very fine, subangular blocky structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in old worm and root channels; neutral; clear, smooth boundary.

B21t—8 to 11 inches, dark-brown (10YR 3/3) silty clay loam; moderate, very fine, subangular blocky structure; firm; few roots; common pores; thick, continuous, dark-brown (7.5YR 3/2) clay films on faces of most peds and in pores and channels; about 18 percent, by volume, is sand coarser than very fine sand; neutral; clear, smooth boundary.

IIB22t—11 to 19 inches, dark-brown (10YR 3/3) gravelly clay loam; moderate, very fine, subangular blocky structure; firm; few roots; common pores; thick dark-brown (7.5YR 3/2) clay films on faces of most peds and in pores and channels; about 25 percent gravel, by volume, mostly rounded, partly weathered dolomite fragments that have some chert and igneous pebbles; mildly alkaline; abrupt, irregular boundary.

IIIR—19 inches, light brownish-gray (2.5Y 6/2) creviced dolomite.

The solum is 10 to 20 inches thick and overlies dolomite. The Ap horizon is very dark grayish brown, dark brown, or dark grayish brown and is 4 to 9 inches thick. The IIB2t horizon is clay loam or sandy clay loam 4 to 12 inches thick. Gravel content of the IIB2t horizon is as much as 30 percent, by volume. In most places the IIIR horizon is creviced, and material from the IIB horizon fills these crevices.

Ritchey soils are near LeRoy, Knowles, and Ripon soils. Ritchey soils are underlain by dolomite bedrock and LeRoy soils by very gravelly sandy loam till in which the coarse fragments are mostly angular dolomite. Ritchey soils are shallower to dolomite than Knowles and Ripon soils and have a thinner or lighter-colored A horizon than Ripon soils.

RhB2—Ritchey silt loam, 2 to 6 percent slopes, eroded. This soil is gently sloping and is on broad ridgetops and upper side slopes in areas where dolomite is at a shallow depth. Areas are elongated and cover 3 to 40 acres.

This soil has a surface layer that is about 2 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of Knowles, LeRoy, and Ripon soils; small areas of sloping and uneroded and severely eroded Ritchey silt loam; and small areas which have dolomite fragments in the surface layer and throughout the surface layer and subsoil. In some places the surface layer is fine sandy loam.

Runoff is medium, and the hazard of erosion is slight to moderate. The soil has a low available water capacity which limits crop yields during most seasons.

With proper management this soil is suited to most of the farm crops commonly grown in the county, but it is better suited to perennial hay and pasture plants. These deep-rooted crops can grow into the soil-filled crevasses of the dolomite and make better use of the shallow root zone. Most of the acreage is used for crops, but a few areas are in native woodland. The main concerns of management are maintaining organic-matter content and tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–3; woodland group 3d1; recreation group 5; wildlife group 4; tree and shrub group 2.

RhC2—Ritchey silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on narrow ridgetops and side slopes in areas where dolomite is at a shallow depth. Areas are elongated and cover 3 to 30 acres.

This soil has a surface layer that is about 2 inches thicker than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of LeRoy, Lomira, Knowles, and Rotamer soils and small areas of gently sloping or moderately steep and uneroded or severely eroded Ritchey silt loam. The surface layer of most of the severely eroded soils is silty clay loam or clay loam. In some areas the surface layer is sandy loam. Also included are small areas where dolomite fragments are on the surface and throughout the surface layer and subsoil.

Runoff is medium, and the hazard of erosion is moderate. The soil has a low available water capacity that limits crop yields during most seasons.

With proper management this soil can be used for most of the farm crops commonly grown in the county, but it is better suited to perennial hay and pasture plants. These deep rooted crops can grow into the soil-filled crevasses of the dolomite and make better use of the shallow root zone. Most of the acreage is used for crops, but a few areas are in native woodland. The main concerns of management are maintaining organic-matter content and tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IVe–3;

woodland group 3d1; recreation group 5; wildlife group 4; tree and shrub group 2.

RhD2—Ritchey silt loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on side slopes along deeply incised natural drainageways and other breaks in the underlying dolomite. Areas are elongated and cover 3 to 30 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of LeRoy, Lomira, Knowles, and Rotamer soils. Also included are small areas of sloping or steep and uneroded or severely eroded Ritchey silt loam. The surface layer of most of the severely eroded soils is silty clay loam or clay loam. In some places the surface layer is sandy loam or dolomite fragments are on the surface and throughout the surface layer and subsoil.

Runoff is rapid, and the hazard of erosion is severe. In some places tillage is hampered by dolomite fragments.

This soil is generally not suited to cultivated crops because of the low available water capacity and the severe hazard of erosion. This soil is better suited to woodland or wildlife habitat. Most of the acreage is in pasture or woodland. Many areas that have been cropped in the past are now idle and reverting back to woodland. Where properly managed this soil can be used for pasture. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIe–3; woodland group 3d2; recreation group 5; wildlife group 4; tree and shrub group 2.

Rock Land and Ritchey Soils

RkE—Rock land and Ritchey soils, 6 to 45 percent slopes. This mapping unit consists of sloping to very steep, well drained to excessively drained, shallow or very shallow soils and exposures of bedrock (fig. 10). Most areas are underlain by dolomite, but small areas are underlain by sandstone. Rock land and Ritchey soils may occur either separately or together in an individual delineation. Where both soils occur, Rock land makes up 30 to 75 percent of the unit. Most areas are long and narrow and cover 3 to 35 acres.

Slopes are generally uniform and convex. Soil material covers the rock in some areas and fills crevices in the dolomite. The soil material is generally less than 20 inches thick, but in some small areas it is 3 to 4 feet thick. It is silt loam, silty clay loam, loam, clay loam, or sandy loam and commonly contains dolomite fragments.

Figure 10.—**Area of Rock land and Ritchey soils. Many exposures of bedrock and fragments of rock are on the surface and scattered throughout the soil material.**

Included in mapping are small areas of Knowles, LeRoy, Lomira, and Markesan soils. Also included are bedrock outcrops that have vertical or nearly vertical slopes.

Runoff is medium to very rapid, and the hazard of erosion is moderate to very severe.

This unit is not suitable for cultivation because of rock fragments and bedrock outcrops. It is better suited to recreation or wildlife habitat. Most areas are in woodland, but some are in native grasses. Some of the acreage is pastured, but yields are low. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIIIs–10; woodland group 6s1; recreation group 5; wildlife group 10; tree and shrub group not assigned.

Rock Outcrop

Ro—Rock outcrop. This mapping unit consists of moderately steep to very steep exposures of igneous bedrock. It is on hills and knobs where the igneous bedrock protrudes through the sedimentary bedrock and glacial deposits. Areas are more than 90 percent bedrock outcrop, rounded in shape, and cover 5 to 35 acres. Slopes are complex.

The rock outcrop is fractured and creviced. Most of the cracks and crevices are filled with soil material that formed mainly in wind-blown material and decaying plant remains. In most areas some trees and some small shrubs grow in these soil-filled crevices. A thin mat of plant litter covers the rock in some areas.

Runoff is very rapid. Except in crevices, erosion removes soil material as fast as it forms. This land is not suitable for cultivation because it is essentially bare bedrock. It is suitable as a source of granite for gravestone and building material and has been quarried for this purpose in the past. It is also suitable for recreation or wildlife habitat. Most of the acreage is in woodland, but tree growth is generally very slow. Capability unit VIIIs–10; woodland group 6s1; recreation group 5; wildlife group 10; tree and shrub group not assigned.

Rodman Series

The Rodman series consists of sloping to very steep, excessively drained soils on outwash plains and terraces. These soils are loamy and are underlain by stratified sand and gravel. The native vegetation was hardwood forest or, on the more open sites, a mixture of prairie grasses and oaks.

In a representative profile the surface layer is very dark grayish-brown gravelly sandy loam about 5 inches thick. The subsoil is brown, very friable gravelly sandy loam 6 inches thick. The substratum is light yellowish-brown, loose sand and gravel to a depth of 60 inches.

The available water capacity is very low, and permeability is very rapid. The depth of root penetration is limited by sand and gravel. Natural fertility is low. The organic-matter content of the surface layer is moderate.

These soils are better suited to close growing pasture plants, woodland, or wildlife habitat than to cultivation. Most of the acreage is used for pasture, woodland, or wildlife habitat. Many areas that were once cultivated are now used for pasture or are idle. There are gravel pits in many areas, and the underlying deposits are a good source of sand and gravel.

Representative profile of Rodman gravelly sandy loam, 6 to 20 percent slopes, 1,225 feet south and 37 feet east of the northwest corner of the SW¼, sec. 16, T. 14 N., R. 12 E., in a cultivated field:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) gravelly sandy loam; weak, fine, granular structure; very friable; many roots; common pores; about 15 percent gravel, by volume; mildly alkaline; abrupt, smooth boundary.

B2—5 to 11 inches, brown (7.5YR 4/4) gravelly sandy loam; weak, medium, subangular blocky structure; very friable; common roots; common pores; clay bridging between sand grains; about 45 percent gravel, by volume; mildly alkaline; abrupt smooth boundary.

C—11 to 60 inches, light yellowish-brown (10YR 6/4) stratified sand and gravel; single grained; loose; strong effervescence; moderately alkaline.

The solum is 8 to 15 inches thick and overlies sand and gravel. The A horizon is black, very dark brown, very dark gray, or very dark grayish brown and is 4 to 8 inches thick. Gravel content ranges from 15 to about 50 percent. The B horizon is gravelly or very gravelly sandy loam or loam 4 to 8 inches thick. The C horizon is layers of sand interbedded with gravel. The thickness of these individual layers ranges from less than 1 inch to several feet.

Rodman soils are near Boyer soils. They have a thinner solum that has more gravel in the upper part than Boyer soils.

RsD—Rodman gravelly sandy loam, 6 to 20 percent slopes. This soil is sloping and moderately steep and is on ridges and knobs and along drainageways of the outwash plains and terraces. Areas are elongated along drainageways and irregularly shaped on ridges and knobs and cover 3 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Boyer soils. Also included are areas of steep and eroded or severely eroded Rodman gravelly sandy loam and areas where the underlying outwash deposits are sandy and lack appreciable gravel content.

Runoff is medium, and the hazard of erosion is severe.

This soil is generally not suited to cultivated crops. It is better suited to woodland or wildlife habitat. Most of the acreage is used for woodland or wildlife habitat, and a few areas are in pasture. Some areas that were once cultivated are now reverting back to woodland. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIs–5; woodland group 4f2; recreation group 2; wildlife group 4; tree and shrub group 2.

RsE—Rodman gravelly sandy loam, 20 to 35 percent slopes. This soil is steep and very steep and is on ridges and knobs and along drainageways of the outwash plains and terraces. Areas are elongated along drainageways and irregularly shaped on ridges and knobs and cover 3 to 25 acres.

This soil has a surface layer about 2 inches thinner than that of the soil described as representative of the series.

Included with this soil in mapping are small areas of moderately steep and eroded Rodman gravelly sandy loam. Also included are areas where the under-

lying outwash deposits are sandy and lack appreciable gravel content.

Runoff is rapid, and the hazard of erosion is very severe.

This soil is best suited to woodland or wildlife habitat, and it is used for those purposes. The main concerns of management are maintaining plant cover and reducing erosion. Capability unit VIIs–5; woodland group 4f2; recreation group 2; wildlife group 4; tree and shrub group 2.

Rotamer Series

The Rotamer series consists of gently sloping to steep, well-drained soils on till plains and moraines. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was a mixed hardwood forest with prairie grasses growing in the more open stands.

In a representative profile the surface layer is very dark grayish-brown sandy loam about 7 inches thick (fig. 11). The subsoil is about 12 inches thick. It is brown, friable loam in the upper part; brown, firm clay loam in the middle part; and brown, friable sandy loam in the lower part. The substratum is brown, very friable gravelly sandy loam to a depth of 60 inches.

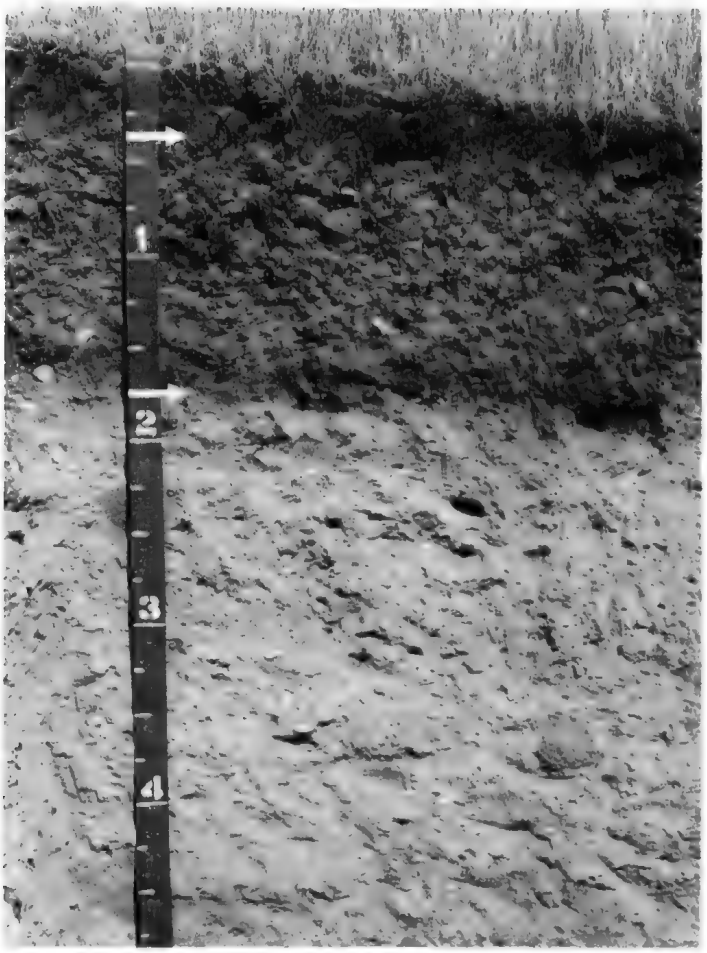

Figure 11.—**Profile of Rotamer soil underlain by gravelly sandy loam glacial till at a depth of about 21 inches.**

The available water capacity is moderate, and permeability is moderate. Natural fertility is medium. The organic-matter content of the surface layer is moderate.

Most areas of gently sloping and sloping soils are used for corn, small grains, legumes, and other crops commonly grown in the county. Most areas of moderately steep and steep soils are used for hay, pasture, woodland, or wildlife habitat.

Representative profile of Rotamer sandy loam, 6 to 12 percent slopes, eroded, approximately 20 feet east and 400 feet north of the southwest corner of sec. 26, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) sandy loam; weak, medium, subangular blocky structure; very friable; common roots; common pores; some brown (7.5YR 4/4) subsoil in worm channels and mixed with matrix by plowing; mildly alkaline; abrupt, smooth boundary.

B21t—7 to 9 inches, brown (7.5YR 4/4) loam; moderate, very fine, subangular blocky structure; friable; common roots; common pores; some very dark grayish-brown (10YR 3/2) soil material in worm and root channels; thin, patchy clay films on faces of peds and in pores and channels; mildly alkaline; clear, smooth boundary.

B22t—9 to 17 inches, brown (7.5YR 4/4) light clay loam; moderate, very fine, subangular blocky structure; firm; common roots; common pores; thin patchy clay films on faces of peds and in pores and channels; mildly alkaline; clear, wavy boundary.

B3t—17 to 19 inches, brown (7.5YR 4/4) sandy loam; weak, medium, subangular blocky structure; friable; common roots; common pores; clay bridging between sand grains; neutral; clear, smooth boundary.

C—19 to 60 inches, brown (10YR 5/3) gravelly sandy loam; massive; very friable; few roots; common pores; about 30 percent gravel, by volume; strong effervescence; moderately alkaline; calcium carbonate equivalent is 20 percent.

The solum is 12 to 24 inches thick and overlies calcareous, gravelly sandy loam till. The A horizon is very dark grayish brown, dark brown, or very dark brown and is 6 to 9 inches thick. The B2t horizon is heavy loam, clay loam, or sandy clay loam 6 to 15 inches thick. Coarse fragments, including cobbles and boulders, in the C horizon range from 5 to about 35 percent, by volume.

Rotamer soils are near Grellton, Griswold, and Kidder soils. Rotamer soils have a thinner solum than the others. They lack the silt loam layer that occurs in the B horizon of Grellton soils.

RtB2—Rotamer sandy loam, 2 to 6 percent slopes, eroded. This soil is gently sloping and is on broad ridgetops and valley floors of the till plains. Areas are irregular in shape and cover 3 to 160 acres.

Included with this soil in mapping are small areas of Lapeer and Okee soils and small areas of sloping and uneroded or severely eroded Rotamer sandy loam. In some small areas slopes are less than 2 percent; the surface layer is silt loam, loam, or loamy fine sand; or gravel or cobbles and boulders are on the surface and throughout the surface layer and subsoil. In other places, the substratum is stratified sand and gravel or dolomite bedrock is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is slight. In some places tillage is hampered by cobbles and boulders.

With proper management, this soil is suitable for

all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

RtC2—Rotamer sandy loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on till plains and moraines. Areas are irregular in shape and cover 3 to 140 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Lapeer and Okee soils and small areas of gently sloping or moderately steep and uneroded or severely eroded Rotamer sandy loam. In some places the surface layer is silt loam, loam, or loamy fine sand; gravel or cobbles and boulders are on the surface throughout the surface layer and subsoil; the substratum is stratified sand and gravel; or dolomite bedrock is at a depth of 45 to 60 inches.

Runoff is medium, and the hazard of erosion is moderate. In some places tillage is hampered by cobbles and boulders.

With proper management, this soil is suitable for all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining organic-matter content, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

RtD2—Rotamer sandy loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is on moraines and along drainageways of the till plains. Areas are long and narrow along drainageways and irregularly shaped on moraines and cover 3 to 40 acres.

This soil has a surface layer and subsoil which, combined, are about 3 to 5 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer and Okee soils and small areas of sloping and uneroded or severely eroded Rotamer sandy loam. In some small areas slopes are as much as 30 percent. In some places the surface layer is silt loam, loam, or loamy fine sand. In some small areas gravel or cobbles and boulders are on the surface and throughout the surface layer and subsoil. And in places the substratum is stratified sand and gravel, or dolomite bedrock is at a depth of 45 to 60 inches.

Runoff is rapid, and the hazard of erosion is severe. In some places tillage is hampered by cobbles and boulders.

This soil is best suited to pasture, woodland, or close-growing crops. Most of the acreage is used for pasture or woodland, and some is used for row crops. The main concerns of management are maintaining the content of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IVe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

RtE—Rotamer sandy loam, 20 to 30 percent slopes. This soil is steep and is on moraines and along drainageways of the till plains. Most areas are elongated and cover 3 to 20 acres.

This soil has a surface layer and subsoil which, combined, are about 2 to 3 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Lapeer soils and small areas of moderately steep and eroded or severely eroded Rotamer sandy loam. In some small areas the surface layer is loam or loamy fine sand; gravel is on the surface and throughout the surface layer and subsoil; the substratum is stratified sand and gravel; or dolomite bedrock is at a depth of 45 to 60 inches.

Runoff is rapid, and the hazard of erosion is very severe.

This soil is generally not suited to row crops. It is better suited to pasture, woodland, or wildlife habitat. Most of the acreage is used for pasture, woodland, or wildlife habitat. The main concerns of management are maintaining plant cover and reducing erosion on pasture. Capability unit VIe–1; woodland group not assigned; recreation group 1; wildlife group 5; tree and shrub group 1.

St. Charles Series

The St. Charles series consists of nearly level to sloping, well drained and moderately well drained soils on till plains. These soils are loamy and are underlain by gravelly sandy loam glacial till. The native vegetation was mixed hardwood forest. Some areas of these soils are saturated with water below a depth of 3 to 5 feet during wet periods.

In a representative profile the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsoil is about 45 inches thick. It is dark yellowish-brown, friable silt loam in the upper part; dark yellowish-brown, firm silt loam grading to yellowish-brown, friable silt loam in the middle part; and dark brown, friable sandy loam in the lower part. The lower part has grayish-brown mottles. The substratum is yellowish-brown, very friable gravelly sandy loam to a depth of 60 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county.

Representative profile of St. Charles silt loam, 2 to 6 percent slopes, approximately 1,075 feet south and 325 feet west of the northeast corner of the SE¼ sec. 6, T. 15 N., R. 13 E., in a cultivated field:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, very fine, granular structure; very friable; common roots; common pores; some dark yellowish-brown (10YR 4/4) subsoil in worm casts and mixed with matrix by plowing; mildly alkaline; abrupt, smooth boundary.

B21t—9 to 13 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, very fine, subangular blocky structure; friable; common roots; common pores; some dark grayish-brown (10YR 4/2) soil material in worm and root channels; many thin clay films on

faces of peds and in pores and channels; neutral; clear, smooth boundary.

B22t—13 to 30 inches, dark yellowish-brown (10YR 4/4) heavy silt loam; moderate, medium, prismatic structure parting to moderate, fine and very fine, subangular blocky; firm; common roots; common pores; few thick clay films on faces of some peds and many thin clay films on faces of peds and in pores and channels; slightly acid; gradual, wavy boundary.

B23t—30 to 48 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, prismatic structure parting to moderate, coarse, subangular blocky; friable; common roots; common pores; few, thick, brown (10YR 4/3) clay films on faces of some peds and in root channels and common, thin clay films on faces of peds and in pores and channels; medium acid; clear, wavy boundary.

IIB3t—48 to 54 inches, dark-brown (7.5YR 4/4) heavy sandy loam; few, fine, prominent grayish-brown (2.5Y 5/2) mottles; weak, coarse, subangular blocky structure; friable; few roots; common pores; few, very thick, very dark brown (10YR 2/2) clay films in channnels and many thin clay films on faces of peds; slightly acid; gradual, wavy boundary.

IIC—54 to 60 inches, yellowish-brown (10YR 5/4) gravelly sandy loam; massive; very friable; few roots; common pores; about 25 percent gravel, by volume; strong efferescence; moderately alkaline; calcium carbonate equivalent is 35 percent.

The solum is 48 to about 70 inches thick and overlies calcareous gravelly sandy loam glacial till. The silty eolian mantle is 40 to about 60 inches thick. The Ap horizon is dark grayish brown, very dark grayish brown, dark brown, or brown and is 6 to 9 inches thick. The B2t horizon is silt loam, heavy silt loam, or silty clay loam 30 to 55 inches thick. The IIB3t horizon is clay loam, sandy clay loam, heavy sandy loam, or sandy loam 4 to 10 inches thick. Coarse fragments, including cobbles and boulders, in the IIC horizon range from 15 to 50 percent, by volume. In some places mottles are in the middle and lower parts of the B horizon and in the C horizon.

St. Charles soils are near Dodge and Lomira soils. They have a thicker mantle of silty eolian sediments and a thicker solum than Dodge and Lomira soils.

ScA—St. Charles silt loam, 0 to 2 percent slopes. This soil is nearly level and is on the broad ridgetops and valley floors of till plains. Areas are rounded or oblong and cover 3 to 60 acres.

This soil has a surface layer and subsoil which, combined, are about 5 inches thicker than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Joy soils and small areas of gently sloping St. Charles silt loam. In places coarse fragments in the substratum are more than 50 percent, by volume, and are mostly angular dolomite fragments. In some places dolomite bedrock is at a depth of 60 to 72 inches or the soil is underlain by stratified sand and gravel.

Runoff is slow. This soil has few limitations.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. This soil can be cropped intensively where management includes regular additions of organic matter and maintaining tilth. Capability unit I–4; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

ScB—St. Charles silt loam, 2 to 6 percent slopes. This soil is gently sloping and is on broad ridgetops and valley floors of the till plains. Areas are irregular in shape and cover 3 to 130 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Joy and LeRoy soils and small areas of nearly level or sloping and eroded or severely eroded St. Charles silt loam. In some places the content of coarse fragments in the substratum is more than 50 percent, by volume and the coarse fragments are mostly angular dolomite. And in places dolomite bedrock is at a depth of 50 to 60 inches or the soil is underlain by stratified sand and gravel.

Runoff is medium, and the hazard of erosion is slight.

This soil is suitable for all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIe–1; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

ScC2—St. Charles silt loam, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes of the till plains. Areas are irregular in shape and cover 3 to 70 acres.

This soil has a surface layer that is about 2 inches thinner than that of the soil described as representative of the series, and the surface layer and subsoil combined are about 6 inches thinner.

Included with this soil in mapping are small areas of Knowles soils and of gently sloping and uneroded or severely eroded St. Charles silt loam. In some places slopes are as much as 20 percent; the content of coarse fragments in the substratum is more than 50 percent, by volume, and the coarse fragments are mostly angular dolomite; dolomite bedrock is at a depth of 45 to 60 inches; or the underlying material is stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate.

With proper management this soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter and good tilth, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

Sisson Series

The Sisson series consists of gently sloping to moderately steep, well-drained soils along drainageways, on till plains, and in old glacial lake basins. These soils are loamy and are underlain by stratified silt, silt loam, and very fine sand lacustrine deposits.

In a representative profile the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil is about 32 inches thick. It is brown loam in the upper part; brown, firm clay loam and dark yellowish-brown, friable loam in the middle part; and brown, friable silt loam in the lower part. The substratum is brown, friable stratified silt, silt loam, and very fine sand to a depth of 60 inches.

The available water capacity is high, and permeability is moderate. Natural fertility is high. The

organic-matter content of the surface layer is moderately low to moderate.

Most of the acreage is used for corn, small grains, legumes, and other crops commonly grown in the county. Some areas are used for pasture, and a few are used as woodland.

Representative profile of Sisson loam, 2 to 6 percent slopes, approximately 400 feet north and 400 feet east of the southwest corner of sec. 23, T. 16 N., R 13 E., in a cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium, granular structure; friable; common roots; common pores; some brown (10YR 4/3) subsurface soil in worm casts and mixed with matrix by plowing; neutral; abrupt, smooth boundary.

B1—7 to 12 inches, brown (10YR 4/3) loam; weak, fine and very fine, subangular blocky structure; friable; common roots; common pores; some dark grayish-brown (10YR 3/2) soil material in old worm and root channels; slightly acid; clear, smooth boundary.

B21t—12 to 34 inches, brown (7.5YR 4/4) clay loam; weak, medium, subangular blocky structure; firm; few roots; common pores; many thin clay films on faces of peds and in pores and channels; slightly acid; clear, smooth boundary.

B22t—34 to 37 inches, dark yellowish-brown (10YR 4/4) loam; moderate, medium, subangular blocky structure; friable; few roots; common pores; many thin clay films on faces of peds and in pores and channels; slightly acid; abrupt, smooth boundary.

IIB3t—37 to 39 inches, brown (10YR 5/3) silt loam; moderate, medium and thick, platy structure parting to moderate, fine and very fine, subangular blocky; friable; few roots; common pores; thin dark-brown (7.5YR 4/4) clay films on faces of peds; a few thin lenses of very fine sand; mildly alkaline; abrupt, smooth boundary.

IIC—39 to 60 inches, brown (10YR 5/3) stratified silt, silt loam, and very fine sand; friable; few pores; strong effervescence; moderately alkaline.

The solum is 24 to 42 inches thick, and free carbonates are at a depth of 24 to 42 inches. The Ap horizon is brown or dark grayish brown and is 6 to 9 inches thick. The B2t horizon is heavy loam, clay loam, or sandy clay loam 12 to 30 inches thick. The IIB3t horizon is silt loam or loam that has some evidence of stratification and is 2 to 6 inches thick. The IIC horizon is dominantly stratified silt, silt loam, and very fine sand but has thin lenses of sand, fine sand, or silty clay loam in places.

Sisson soils are near Briggsville and Kibbie soils. Sisson soils are underlain by stratified silt, silt loam, and very fine sand and Briggsville soils by stratified silt clay loam, silty clay, and clay. Sisson soils are well drained, and Kibbie soils are somewhat poorly drained.

SnB—Sisson loam, 2 to 6 percent slopes. This soil is gently sloping and is along drainageways of the till plains and old glacial lake basins. Areas are irregular in shape and cover 3 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Kibbie soils and of sloping and eroded or severely eroded Sisson loam. Some small areas have slopes of less than 2 percent. In some places the surface layer is sandy loam or loamy fine sand or the sandy mantle is more than 20 inches thick. And some small areas are underlain by massive silts which lack stratification or by stratified sand and gravel.

Runoff is medium, and the hazard of erosion is slight.

This soil is suited to all the farm and vegetable crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIe–1; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

SnC2—Sisson loam, 6 to 12 percent slopes, eroded. This soil is sloping and is along drainageways of the till plains and old glacial lake basins. Areas are elongated to irregular in shape and cover 3 to 35 acres.

This soil has a surface layer and subsoil which, combined, are about 3 to 5 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of gently sloping or moderately steep and uneroded or severely eroded Sisson loam. In some places the surface layer is sandy loam or loamy fine sand. Some small areas have a sandy mantle more than 20 inches thick, are underlain by massive silts which lack stratification, or are underlain by stratified sand and gravel.

Runoff is medium, and the hazard of erosion is moderate.

This soil is suited to all the farm crops commonly grown in the county. Most of the acreage is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IIIe–1; woodland group 1o1; recreation group 1; wildlife group 1; tree and shrub group 1.

SnD2—Sisson loam, 12 to 20 percent slopes, eroded. This soil is moderately steep and is along drainageways and depressions of the till plains and old glacial lake basins. The areas are elongated to irregular in shape and cover 3 to 25 acres.

This soil has a surface layer and subsoil which, combined, are about 3 to 5 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of sloping and uneroded or severly eroded Sisson loam. In some places the surface layer is sandy loam or loamy fine sand. Some small areas have a sandy mantle that is more than 20 inches thick, are underlain by massive silts which lack stratification, or are underlain by stratified sand and gravel.

Runoff is rapid, and the hazard of erosion is severe.

This soil is best suited to pasture, woodland, or close growing crops. Most of the acreage is used for pasture or woodland, and some is used for crops. The main concerns of management are maintaining the level of organic matter, conserving moisture, reducing runoff, and controlling erosion. Capability unit IVe–1; woodland group 1r1; recreation group 1; wildlife group 1; tree and shrub group 1.

Tustin Series

The Tustin series consists of nearly level and gently sloping, well-drained soils in old glacial lake basins. These soils are sandy and have a clayey subsoil underlain by clayey lacustrine deposits.

In a representative profile the surface layer is very dark grayish-brown loamy fine sand about 8 inches thick. The subsurface layer is yellowish-brown and

pale-brown, loose fine sand 26 inches thick. The subsoil is reddish-brown, firm clay 14 inches thick. The substratum is reddish-brown, firm silty clay to a depth of 60 inches.

The available water capacity is low. Permeability is rapid in the sandy upper layer and slow in the clayey lower layer. Natural fertility is low. The organic-matter content of the surface layer is low.

Most of the acreage is used for corn, small grains, legumes, and pasture.

Representative profile of Tustin loamy fine sand, 1 to 6 percent slopes, approximately 500 feet south and 500 feet east of the northwest corner of NE¼ of sec. 2, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) loamy fine sand; weak, medium, granular structure; very friable; common roots; common pores; slightly acid; abrupt, smooth boundary.

A21—8 to 31 inches, yellowish-brown (10YR 5/4) fine sand; very weak, coarse, subangular blocky structure, single grained where disturbed; loose; few roots; many pores; neutral, clear, smooth boundary.

A22—31 to 34 inches, pale-brown (10YR 6/3) fine sand; many, medium, prominent, yellowish-brown (10YR 5/6) mottles; very weak, fine, subangular blocky structure; loose; few roots; many pores; neutral; clear, smooth boundary.

IIB22t—34 to 42 inches, reddish-brown (5YR 4/4) clay; moderate, medium, prismatic structure parting to moderate, very fine, angular and subangular blocky; firm; few roots; common pores; thin discontinuous clay films on faces of peds; some gray (5Y 6/1) coatings on faces of peds in cracks, especially in upper few inches of this horizon; slightly acid; clear, smooth boundary.

IIB23t—42 to 48 inches, reddish-brown (5Y 4/4) clay; moderate, medium, prismatic structure parting to moderate, very fine, subangular blocky; firm; few pores; thin discontinuous clay films on faces of peds and gray (5Y 6/1) coatings of sandy loam on faces of a few peds; slightly acid; gradual, irregular boundary.

IIC—48 to 60 inches, reddish-brown (5YR 4/4) silty clay; weak, medium, prismatic structure parting to weak, fine and very fine, subangular blocky; firm; mildly alkaline.

The solum is 30 to 50 inches thick. The sandy mantle is 20 to 40 inches thick. The Ap horizon is very dark grayish brown, dark brown, or dark grayish brown and is 6 to 9 inches thick. The A21 horizon is loamy fine sand, loamy sand, sand, or fine sand 8 to 25 inches thick. The A22 horizon is loamy fine sand, loamy sand, sand, or fine sand 3 to 10 inches thick. The IIB2t horizon is clay or silty clay 8 to 15 inches thick. The IIC horizon is clay or silty clay.

Tustin soils are near Briggsville and Zittau soils. Tustin soils have a 20- to 40-inch sandy mantle which Briggsville and Zittau soils lack. They are well drained, and Zittau soils are somewhat poorly drained. They are underlain by clayey lacustrine deposits and Zittau soils by sand.

TuB—Tustin loamy fine sand, 1 to 6 percent slopes. This soil is nearly level and gently sloping and is in old glacial lake basins. Areas are elongated to irregular in shape and cover 3 to 80 acres.

Included with this soil in mapping are small areas of Brems, Briggsville, Oakville, and Okee soils, and small areas of sloping and eroded Tustin loamy fine sand. In some places the surface layer is sand or fine sand, or more clay and less sand is in the surface and subsurface layers than in the representative soil. And in some places, the substratum is stratified silt loam, silty clay loam, silty clay, clay, and fine sand.

Runoff is slow. The hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons. Planting early in spring, before the soil has a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival.

This soil is suited to irrigation. Most of the acreage is used for general farm crops. With fertilization, supplemental irrigation, and protection from soil blowing, this soil can be used for farm crops and certain vegetable crops. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIe–4; woodland group 3o1; recreation group 3; wildlife group 2; tree and shrub group 2.

Urne Series

The Urne series consists of gently sloping to steep, somewhat excessively drained soils on hills and ridges where the soil is relatively thin over glauconitic sandstone. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 7 inches thick. The subsoil is about 30 inches thick. It is yellowish-brown, friable fine sandy loam in the upper part; dark yellowish-brown, friable gravelly fine sandy loam in the middle part; and olive-brown and olive, friable fine sandy loam in the lower part. The substratum is layers of light olive-brown, olive, and yellowish-brown, weakly cemented sandstone to a depth of 60 inches.

The available water capacity is low, and permeability is moderately rapid. The depth of root penetration is limited by the underlying sandstone. Natural fertility is low. The organic-matter content of the surface layer is low.

Most of the gently sloping and sloping acreage is used for corn, small grains, and legumes. Most of the moderately steep and steep acreage is used for pasture, woodland, or wildlife habitat.

Representative profile of Urne loamy fine sand, 2 to 6 percent slopes, approximately 500 feet north and 800 feet west of the center of sec. 21, T. 14 N., R. 11 E., in a cultivated field:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, fine and very fine, subangular blocky structure; very friable; common roots; common pores; slightly acid; abrupt, smooth boundary.

B1—7 to 18 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine and very fine, subangular blocky structure; friable; few roots; common pores; about 10 percent sandstone pebbles, by volume; slightly acid; gradual, smooth boundary.

B21—18 to 22 inches, dark yellowish-brown (10YR 4/4) gravelly fine sandy loam; weak, medium and fine, subangular blocky structure; friable; few roots; about 20 percent sandstone pebbles, by volume; strongly acid; clear, smooth boundary.

B22—22 to 37 inches, mixed olive (5Y 5/4) and olive-brown (2.5Y 4/4) fine sandy loam; weak, medium and fine, subangular blocky structure; friable; few roots; common pores; about 10 percent sandstone pebbles, by volume; strongly acid; gradual, irregular boundary.

C—37 to 60 inches, layers of light olive-brown (2.5Y 5/4), olive (5Y 5/4), and yellowish-brown (10YR 5/4) weakly cemented sandstone; moderately alkaline.

The solum is 20 to 40 inches thick and overlies sandstone bedrock. The Ap horizon is very dark grayish brown, dark grayish brown, or dark brown and is 6 to 9 inches thick. The B1 horizon is sandy loam or fine sandy loam 5 to 15 inches thick. The B2 horizon is sandy loam or fine sandy loam 8 to 20 inches thick.

These soils are more acid in the B horizon and more alkaline in the C horizon than is defined as the range for the series, but these differences do not alter their usefulness or behavior.

Urne soils are near Gotham sandstone substratum soils and have similar drainage to the Mecan soils. They have less sand and more clay in the solum than Gotham sandstone substratum soils. They have a thinner solum than Mecan soils. Urne soils are underlain by glauconitic sandstone bedrock, and Mecan soils by gravelly loamy sand till.

UrB—Urne loamy fine sand, 2 to 6 percent slopes. This soil is gently sloping and is on the broad ridgetops and valley floors in areas where the depth to sandstone is relatively shallow. Areas are irregular in shape and cover 3 to 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Gotham and Mecan soils and small areas of sloping and eroded or severely eroded Urne loamy fine sand. In some small areas the surface layer is loam or fine sandy loam or the underlying sandstone contains no glauconite.

Runoff is medium. The hazard of erosion is slight. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons.

Where properly managed, this soil is suitable for most of the farm crops commonly grown in the county. Most of the acreage is used for crops and pasture, but some is in woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, and controlling erosion and soil blowing. Capability unit IIIs–4; woodland group 3o1; recreation group 4; wildlife group 3; tree and shrub group 2.

UrC2—Urne loamy fine sand, 6 to 12 percent slopes, eroded. This soil is sloping and is on side slopes where the depth to sandstone is relatively shallow. Most areas are elongated and cover 3 to 25 acres.

This soil has a surface layer and subsoil which, combined, are about 3 to 5 inches thinner than in the soil described as representative of the series.

Included with this soil in mapping are small areas of Gotham, Lapeer, and Mecan soils and small areas of gently sloping or moderately steep and uneroded or severely eroded Urne loamy fine sand. In some small areas the surface layer is loam or fine sandy loam or the underlying sandstone contains no glauconite.

Runoff is medium. The hazard of erosion is moderate. This soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons.

This soil is best suited to pasture, woodland, or wildlife habitat. Many areas are used for crops and pasture, but some are in woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IIIe–7; woodland group 3o1; recreation group 4; wildlife group 3; tree and shrub group 2.

UrD2—Urne loamy fine sand, 12 to 30 percent slopes, eroded. This soil is moderately steep and steep and is on side slopes in areas where the depth to sandstone is relatively shallow. Most areas are elongated and cover 3 to 15 acres.

This soil has a surface layer 1 to 2 inches thinner than that of the soil described as representative of the series, and the surface layer and subsoil combined are 4 to 6 inches thinner.

Included with this soil in mapping are small areas of Gotham sandstone substratum, Lapeer, Oakville, and Okee soils, and small areas of sloping and uneroded or severely eroded Urne loamy fine sand. In some small areas the surface layer is loam or fine sandy loam or the underlying sandstone contains no glauconite.

Runoff is rapid. The hazard of erosion is severe. The soil is subject to soil blowing. It has a low available water capacity that limits crop yields during most seasons.

This soil is best suited to pasture, woodland, or wildlife habitat. Some of the acreage is used for crops, and some is in woodland. The main concerns of management are regularly supplying additions of organic matter, conserving moisture, reducing runoff, and controlling erosion and soil blowing. Capability unit IVe–7; woodland group 3r1; recreation group 4; wildlife group 3; tree and shrub group 2.

Willette Series

The Willette series consists of nearly level, very poorly drained soils on flood plains and in drainageways, depressions, and old glacial lake basins. These soils are organic and are underlain by clayey lacustrine deposits. The native vegetation was marsh plants such as sedges, reeds, and grasses; shrubs such as willow, alder, and dogwood; and trees such as tamarack. Unless these soils are drained, ground water is at or near the surface throughout the year.

In a representative profile the organic layer is black nonsticky muck about 30 inches thick. The substratum, to a depth of 36 inches, is mixed dark gray and very dark gray, firm silty clay. Below this, is reddish-gray, firm clay mottled with gray and light olive brown to a depth of 60 inches.

The available water capacity is very high. Permeability is rapid in the organic layers and slow in the substratum. The depth of root penetration is limited by the water table. Natural fertility is low.

Where drained, most of the acreage is used for corn. Undrained areas provide good wetland wildlife habitat, and some are used for unimproved pasture.

Representative profile of Willette muck, approximately 390 feet west and 30 feet north of the center of sec. 30, T. 17 N., R. 13 E., in a formerly cultivated field, now idle:

Oap—0 to 8 inches, black (N 2/0 broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; weak, fine, granular structure; nonsticky; mainly herbaceous fibers; neutral; abrupt, smooth boundary.

Oa2—8 to 16 inches, black (N 2/0 broken face and rubbed) sapric material; about 5 percent fiber, a trace rubbed; weak, fine and medium, granular structure; nonsticky; mainly herbaceous fibers; neutral; abrupt, smooth boundary.

Oa3—16 to 23 inches, black (5YR 2/1 broken face and

rubbed) sapric material; about 50 percent fiber, 5 percent rubbed; weak, thick, platy structure; nonsticky; mainly herbaceous fibers; mildly alkaline; gradual, wavy boundary.

Oa4—23 to 30 inches, black (N 2/0 broken face and rubbed) sapric material; about 20 percent fiber, less than 5 percent rubbed; weak, thick, platy structure; nonsticky; mainly herbaceous fibers; thin strata of dark gray (N 4/0) silty clay below a depth of 28 inches; mildly alkaline; gradual, smooth boundary.

IIC1g—30 to 36 inches, mixed dark-gray (5Y 4/1) and very dark gray (5Y 3/1) silty clay; massive; firm; few herbaceous fibers and woody fragments; mildly alkaline; diffuse, wavy boundary.

IIC2—36 to 60 inches, reddish-gray (5Y 5/2) clay; common, fine, distinct, gray (N 5/0) mottles and few, fine, prominent, light olive-brown (2.5Y 5/4) mottles; massive; firm; a few plant fibers in the upper part; violent effervescence; moderately alkaline.

The organic layer is 16 to 50 inches thick. The organic part of the subsurface and bottom tiers is mainly sapric material. In some places, however, thin layers of hemic material or fibric material are in the lower part of the organic layer. The organic material is mainly derived from herbaceous plants, but a few woody fragments ⅛ inch to several inches in diameter are in the lower part of the organic layer in some places. The IIC horizon is clay or silty clay.

Willette soils are near Poy and Poygan soils. They are underlain by clayey lacustrine deposits, and Poy soils are underlain by sand. They have a 16- to 50-inch organic layer which Poy and Poygan soils lack.

We—Willette muck. This soil is nearly level and is on flood plains and in drainageways, depressions, and old glacial lake basins. Most areas are irregular in shape and 3 to 200 acres in size, but one covers more than 1,100 acres.

Included with this soil in mapping are small areas of Granby clayey subsoil variant, Houghton, Palms, Poy, and Poygan soils. Also included are small areas that have as much as 16 inches of recent loamy overwash.

Runoff is very slow. This soil is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Tiles should be placed in the organic layer if possible, because of the slow permeability of the clayey substratum. If the tile must be placed in the clayey substratum, it should be backfilled with porous material. Cultivated areas are subject to burning and soil blowing. If the water table is lowered excessively in such areas, the organic matter decomposes very rapidly and subsidence also becomes a problem.

Where drained, this soil is suitable for certain vegetable crops such as lettuce, beets, and carrots. Drained areas are used for corn. Undrained areas are used for wetland wildlife habitat, and some are used for unimproved pasture. Capability unit IIIw–8; woodland group 3w3; recreation group 8; wildlife group 8; tree and shrub group 4.

Zittau Series

The Zittau series consists of nearly level and gently sloping, somewhat poorly drained soils in old glacial lake basins. These soils have a clayey and loamy subsoil underlain by sandy deposits. The native vegetation was mixed prairie grasses and hardwood forest. Unless these soils are drained, they are saturated with water below a depth of 1 to 3 feet during wet periods.

In a representative profile the surface layer is black silty clay loam about 8 inches thick. The subsoil is about 22 inches thick and has dark reddish-gray, light brownish-gray, and olive-gray mottles. It is reddish-brown, firm clay in the upper part and reddish-brown, firm clay loam in the lower part. The substratum is reddish-brown, very friable loamy fine sand in the upper part and light yellowish-brown, very friable fine sand to a depth of 60 inches. The substratum has light brownish-gray, reddish-brown, and very pale brown mottles.

The available water capacity is moderate. Permeability is slow in the subsoil and rapid in the substratum. The depth of root penetration is limited by saturated soil during wet periods of the growing season. Natural fertility is medium. The organic-matter content of the surface layer is moderate.

Where drained, most of the acreage is used for corn, small grains, legumes, and pasture. Undrained areas provide good wildlife habitat, and some are used for unimproved pasture.

Representative profile of Zittau silty clay loam, 0 to 3 percent slopes, approximately 35 feet south and 600 feet west of the center of sec. 10, T. 17 N., R. 13 E., in a cultivated field:

Ap—0 to 6 inches, black (10YR 2/1) silty clay loam; weak, medium, subangular blocky structure; friable; few roots; common pores; medium acid; abrupt, smooth boundary.

A12—6 to 8 inches, black (10YR 2/1) silty clay loam; weak, fine and very fine, subangular blocky structure; firm; few roots; common pores; some reddish-brown (5YR 4/3) subsoil in worm casts; medium acid; abrupt, smooth boundary.

B21t—8 to 13 inches, reddish-brown (5YR 4/3) clay; moderate, fine and very fine, angular blocky structure; firm; few roots; few pores; some black (10YR 2/1) soil material on faces of peds and in worm and root channels and many thin clay films on faces of peds; slightly acid; clear, smooth boundary.

B22t—13 to 24 inches, reddish-brown (5YR 4/4) clay; few, fine, distinct, dark reddish-gray (5YR 4/2) mottles; moderate, fine and very fine, angular blocky structure; firm; few roots; few pores; many thin clay films on faces of peds; neutral; clear, smooth boundary.

B3t—24 to 30 inches, reddish-brown (5YR 4/4) clay loam; many, medium, prominent, light brownish-gray (2.5Y 6/2) and olive-gray (5Y 5/2) mottles; moderate, medium, prismatic structure parting to weak, medium, subangular blocky; firm; few roots; common pores; thin clay films on faces of peds; some pockets of sandy loam; about 35 percent clay, by volume; neutral; clear, wavy boundary.

IIC1—30 to 42 inches, reddish-brown (5YR 4/4) loamy fine sand; common, medium, prominent, light brownish gray (2.5Y 6/2) mottles; weak, fine, subangular blocky structure; very friable; neutral; abrupt, smooth boundary.

IIC2—42 to 60 inches, light yellowish-brown (10YR 6/4) fine sand; common, medium, prominent, reddish-brown (5YR 4/4) mottles and common, medium, faint, very pale brown (10YR 7/4) mottles; weak, medium and fine, subangular blocky structure; very friable; mildly alkaline.

The solum is 20 to 40 inches thick. The A horizon is black, very dark brown, very dark gray, very dark grayish brown, or dark brown and is 6 to 9 inches thick. The B2t horizon is silty clay or clay 10 to 20 inches thick. The B3t

horizon is sandy clay loam, sandy clay, or clay loam 3 to 8 inches thick. The IIC horizon is loamy sand, loamy fine sand, sand, or fine sand.

Zittau soils are near Manawa, Poy, and Tustin soils. Zittau soils are underlain by sand, and Manawa soils by clayey lacustrine deposits. Zittau soils are somewhat poorly drained, Poy soils are poorly drained, and Tustin soils are well drained. Zittau soils lack the 20– to 40–inch sandy mantle characteristic of Tustin soils.

ZtA—Zittau silty clay loam, 0 to 3 percent slopes. This soil is nearly level and gently sloping and is in old glacial lake basins. Areas are irregular in shape and 3 to 40 acres in size, but one area covers about 140 acres.

Included with this soil in mapping are small areas of Manawa and Tustin soils. In some small areas the surface layer is silt loam, loam, or clay loam or loamy or clayey strata are in the substratum.

Runoff is slow. This soil receives runoff from adjoining areas and is likely to be ponded during wet seasons and after heavy rains. Surface drainage is used to remove excess surface water rapidly. Both deep ditches and tile drains are used for internal drainage. Care must be taken, however, to prevent loose sand from entering the tile lines.

Undrained areas are suitable for wildlife habitat. Where drained, most of the acreage is used for crops. Undrained areas are used for unimproved pasture. Capability unit IIw–5; woodland group 3c2; recreation group 6; wildlife group 6; tree and shrub group 3.

Use and Management of the Soils

This section contains information about the use and management of the soils of Green Lake County for crops and pasture, woodland, wildlife, recreation, and engineering. It explains the system of capability classification used by the Soil Conservation Service and gives predicted yields of the principal crops grown in the county under a high level of management.

This section also groups the soils according to their suitability for woodland and wildlife habitat. It contains tables that give ratings of the soils for farm and nonfarm uses and for recreation, and it contains information about soils that is significant in engineering.

Crops and Pasture

Crops commonly grown in the survey area are corn, oats, hay, forage crops, sweet corn, peas, and other special crops. In addition, a fairly large acreage is used for pasture. In the following pages, basic practices for managing the soils for these commonly grown crops and pasture are discussed, the system of capability classification is explained, and the capability units are described. Finally, average yields are predicted for some of the principal crops under a high level of management.

The soils of Green Lake County vary in their suitability for specific crops, and they require widely different management. Some basic management practices are needed, however, for practically all of the soils. The following paragraphs discuss basic practices needed for maintaining fertility, providing drainage, and controlling erosion and they discuss renovation of pastures. These practices should be considered in the light of management suggested in the capability units. Technical assistance in planning and applying suitable practices for the soils on a particular farm can be obtained from a local representative of the Soil Conservation Service or the Extension Service.

Fertility can be maintained or increased by using a cropping system that provides for regular additions of organic matter to the soils. It can also be increased by applying barnyard manure or adding commercial fertilizer. A diversified cropping system is used on dairy or beef farms and barnyard manure is added. Where truck farming is practiced or other special crops are grown intensively, fertility is maintained by plowing under a green-manure crop and returning all crop residues to the soil. Controlling erosion also helps to maintain fertility.

The organic-matter content of the soils of Green Lake County ranges from less than 1 percent to more than 20 percent. The well decomposed organic matter or humus in the soil has a great affect on the ability of a soil to retain plant nutrients. The organic-matter content also influences the infiltration rate, tilth, and water-holding capacity of the surface layer. Many of the newer herbicides have suggested rates of application based on the organic-matter content of the surface layer; where the rates have not been followed, crops were damaged or weeds flourished.

The general level of organic matter is listed for each soil series in the section "Description of the Soils." These classes and percentages of organic matter are defined in the Glossary.

The amount and kind of commercial fertilizer to apply depend on the supply of plant nutrients in the soil, the ability of the soil to retain nutrients, the amount of available water, the kinds of crops to be grown, and the crop rotation. Lime and fertilizer should be added according to results of soil tests. An indirect benefit from a higher level of fertility is the production of more plant litter and organic matter, which reduce erosion and promote good soil tilth.

Any given field may contain several soils that differ in acidity. Generally, the deep, well drained and moderately well drained, permeable soils, such as Friesland, Plano, and St. Charles soils, need the heaviest applications of lime. Shallow soils, such as Rotamer soils, need less lime. Some soils, such as the very shallow Rodman soils, do not need lime. Generally, poorly drained soils, such as Ossian soils, need little or no lime.

The available water capacity is given to a depth of 5 feet or to bedrock for the soils in each capability unit description. These ratings are defined in the Glossary and are also listed for each series in the section "Descriptions of the Soils."

As an example, assuming that alfalfa and corn require 0.30 inch of water per day during their peak use period, the number of days that a given soil will support these crops without rainfall can be determined. Thus, the soils that have a high available water capacity, between 9 and 12 inches, will support these crops for 30 to 40 days without rain, if the moisture content is at field capacity at the beginning

of this period. In contrast, soils that have a low available water capacity, between 3 and 6 inches, will support these crops for only 10 to 20 days without rain under similar conditions.

The available water capacity is very important in determining levels of fertilization and population of plants where no irrigation is planned. A high level of fertilization is generally not justified on soils that have very low or low available water capacity, because crop growth is limited by the available water capacity. The soils that have very low and low available water capacity are coarse textured or have a thin solum. Excessive amounts of nitrate fertilizer added to these soils may be quickly leached from the soil and contaminate surface or ground water.

Drainage can be improved in most of the wet soils if there are suitable outlets. Surface drains, tile drains, open-ditch drains, or a combination of these are used to provide drainage. Diversions can be used in some places to protect the soils from runoff from adjacent areas. Soils on flood plains need protection from flooding.

Barry, Joy, Marcellon, and Poygan soils are well suited to both surface and tile drainage. Granby, Marshan, and Poy soils generally are not suited to tile drainage but are well suited to surface and open-ditch drainage. Organic soils of the Adrian and Edwards series generally are not suited to tile drainage, but are well suited to open-ditch drainage. Both tile and open-ditch drainage can be used on the organic Houghton, Palms, and Willette soils.

When organic soils are drained, subsidence is a hazard. Subsidence is the loss of surface elevation, and it amounts to approximately ½ to 1 inch a year in Wisconsin. The subsidence potential is high for Adrian, Edwards, Palms, and Willette soils and very high for Houghton soils.

Subsidence of organic soils after drainage is attributed mainly to four factors: loss of buoyancy caused by ground water, consolidation, compaction, and biochemical activity. Initial subsidence is loss of elevation caused by the first three factors and is normally accomplished in about 3 years after the water table is lowered. Initial subsidence typically results in a one-half reduction in thickness of the organic materials above the water table.

After initial subsidence, shrinkage continues at a fairly uniform rate because of biochemical oxidation of the organic materials. This continued subsidence progresses until the water table reaches mineral material. The rate of continued subsidence depends on the depth to the water table and increases with depth. Subsidence of organic soils can be stopped by maintaining the water level at the surface. It can be slowed by maintaining the water level as high as possible for the land use.

In the county, many of the soils are moderately eroded. Markesan, Ritchey, and Rotamer soils are examples. Most of the water erosion is in the form of sheet and rill erosion, although some gullying also occurs.

Practices that help to control water erosion are terracing, using grassed waterways, stripcropping, contour tilling, growing sod crops or cover crops in rotations, and mulching with crop residue.

Minimum tillage is very effective in controlling water erosion. Where it is used in planting row crops, a minimum area of soil is disturbed. Special "no-till" planters knife open the seed bed, put in the seed and starter fertilizer, close the seed bed, and apply a herbicide–all in one operation. The proper kind and amount of herbicide is very important in minimum tillage. If the herbicide does not control the weeds, it must be done by cultivation, thus reducing the effectiveness of the original minimum tillage.

Most of the soils are subject to soil blowing. Soil blowing is evident in sandy Oakville, Gotham, and Richford soils. It is also evident in drained areas of organic soils and wet sandy Houghton and Granby soils. Practices that help to control soil blowing are stripcropping at right angles to the direction of prevailing winds, stubble mulching, leaving crop residue on the surface, growing cover crops or meadow crops, establishing shelterbelts, and controlling drainage in organic soils and wet sandy soils. Many of these practices also help to catch snow and add moisture to the soil.

Most upland pastures on well-drained soils of capability classes II, III, IV, and VI need renovating. A good seedbed should be prepared and a suitable mixture of grasses and legumes seeded. Suitable mixtures for seeding are alfalfa with bromegrass or birdsfoot trefoil with bromegrass.

Large amounts of phosphorus and potassium are needed at the time of seeding. Nitrogen should be applied as a topdressing, especially if grasses are dominant. Applying fertilizer annually or renovating permanent pasture every five years helps to maintain good forage quality. Rotation of grazing protects and extends the life of the forage plants.

Alluvial land, wet, the only soil in capability class V, has a high water table and is subject to flooding. Tillage is not practical, and renovation is not feasible. This soil is generally kept in reed canarygrass or bromegrass. It should be grazed only in dry seasons; hummocks, which hinder surface drainage, develop if the soil is grazed when wet.

Pastures on soils of class VI are difficult to renovate, and soils of class VII are not suitable for renovation. Where tillage is not practical, these soils are generally kept in native vegetation. Control of grazing and addition of commercial fertilizer are ways to maintain fertility and plant cover.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops (*23*). The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a

substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w, s,* and *c,* because the soils in class V are subject to little or no erosion, although they have other limitations that restrict their use largely to pasture, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIe–7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages, the capability units in Green Lake County are described and suggestions for use and management of the soils in each unit are given. The capability units are not numbered consecutively, because not all of the units used in Wisconsin are in this county. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

CAPABILITY UNIT I–4

This unit consists of nearly level, well drained and moderately well drained, loamy soils underlain by gravelly sandy loam or very gravelly sandy loam.

These soils are moderately permeable. The available water capacity is moderate, high, or very high, and fertility is medium or high.

In some areas, soils are saturated with water below a depth of 3 to 5 feet during wet periods. They are easily worked and have few limitations.

These soils are well suited to and can be used intensively for corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture. The soils can support a large population of plants. Some soils respond well to fertilization, but some do not respond as well because they have a moderate available water capacity. The soils that have a fine sandy loam surface layer are subject to soil blowing during dry periods. Row crops can be grown year after year with no deterioration of soil tilth or decrease in organic-matter content if soils are properly fertilized and if minimum tillage is used to return crop residue to the soil.

CAPABILITY UNIT IIe–1

This unit consists of gently sloping, well drained and moderately well drained, loamy soils underlain by gravelly sandy loam, very gravelly sandy loam, silt loam, or stratified silt, silt loam, and very fine sand.

These soils are moderately permeable. The available water capacity is moderate, high, or very high, and natural fertility is medium or high.

Some areas are saturated with water below a depth of 3 to 5 feet during wet periods. These soils are slightly susceptible to erosion, but some areas that have been cropped have lost as much as 4 inches of the original surface layer through erosion.

Crop rotation, contour farming, stripcropping, diversions, terraces, minimum tillage, and good residue management help control erosion and maintain good tilth. These soils are easily worked if they have not been eroded. Some soils in this unit do not respond to fertilization as well as others because they have moderate available water capacity. The soils that have a fine sandy loam surface layer are subject to soil blowing during dry periods. Response is good to heavy applications of fertilizer. These soils can support a large population of plants.

Under proper management, these soils are well suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture.

CAPABILITY UNIT IIe–2

This unit consists of gently sloping and some nearly level, well-drained, loamy soils underlain by dolomite.

These soils are moderately permeable. The available water capacity is moderate, and natural fertility is medium or high.

The depth of root penetration is limited by dolomite. These soils are slightly susceptible to erosion. Some gently sloping soils that have been cropped have lost as much as 4 inches of the original surface layer through erosion.

Crop rotation, contour stripcropping, diversions, terraces, minimum tillage, and good management of crop residue help control erosion and maintain tilth. If these soils are not eroded, they are easily worked.

Under proper management, these soils are well suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture.

CAPABILITY UNIT IIe–6

This unit consists of nearly level and gently sloping, well drained and moderately well drained, loamy soils that have clayey subsoils underlain by silty clay loam, silty clay, or clay.

These soils are moderately slowly permeable. The available water capacity is moderate, and natural fertility is medium.

In some areas, these soils are saturated with water below a depth of 3 to 5 feet during wet periods. These soils are slightly susceptible to erosion. Some areas that have been cropped have lost as much as 4 inches of the original surface layer through erosion. These soils dry out slowly in spring and after heavy rains. Because of the clayey subsoil, rainwater does not readily enter these soils and the silt loam surface layer is easily eroded. Tilth is poor where erosion has removed the surface layer and exposed the subsoil. The soils dry slowly in spring, and water stands in low spots after heavy rains. Nearly level soils are only slightly susceptible to erosion but are subject to ponding after heavy rains.

Crop rotation, contour stripcropping, diversions, surface drainage, terraces, minimum tillage, and good management of crop residue help control erosion, remove surface water, and maintain good tilth. If the soils are not eroded, they are easily worked.

Under proper management, these soils are suited to corn, soybeans, small grains, legumes, and vegetable crops. They are also well suited to pasture.

CAPABILITY UNIT IIw–1

This unit consists of nearly level, poorly drained, loamy soils underlain by gravelly loamy sand, stratified silt loam, silt and fine sand, silt loam, or silty clay.

These soils are moderately permeable or slowly permeable. The available water capacity is moderate, high, or very high, and natural fertility is medium or high.

Unless these soils are drained, ground water is at or near the surface throughout the year. The soils receive runoff from adjoining areas; some are subject to ponding and to flooding unless protected.

Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. If tile drains are installed in soils that are underlain by stratified silt loam, silt, and fine sand, precautions must be taken to prevent loose sand from entering and clogging the tile lines.

If drained and protected from flooding, these soils are well suited to corn, soybeans, small grains, legumes, and certain vegetable crops. Response is good to heavy applications of fertilizer. These soils can support a large population of plants. Row crops can be grown year after year with no deterioration of soil tilth or decrease in organic-matter content if soils are properly fertilized, and if minimum tillage is used to retain crop residue. Undrained soils are suited to pasture or wetland wildlife habitat.

CAPABILITY UNIT IIw–2

This unit consists of nearly level soils and some gently sloping soils that are somewhat poorly drained. These are loamy soils underlain by silt loam, silt, and very fine sand, gravelly sandy loam, or silty clay loam.

These soils are moderately permeable or slowly permeable. The available water capacity is high or very high, and natural fertility is high.

Unless the soils are drained, they are saturated with water below a depth of 1 to 3 feet in wet periods. They receive runoff from adjoining areas. Some areas are subject to ponding in wet periods and after heavy rain.

Tile drainage and deep ditches can be used to remove excess water if a suitable outlet is available. If tile drains are installed in soils that are underlain by stratified silt loam, silt, or very fine sand, precautions must be taken to prevent loose sand from entering and clogging the tile lines. Diversions and grassed waterways help to intercept and safely remove runoff from adjoining areas. Surface drainage helps to remove water and prevent ponding. Cultivation when the soil is at the proper moisture content keeps tillage to a minimum, and crop residue management helps maintain good tilth.

If drained and protected from flooding, these soils are well suited to corn, soybeans, small grains, legumes, and certain vegetable crops. Response is good to heavy applications of fertilizer. The soils can support a large population of plants. Row crops can be grown year after year with no deterioration of soil tilth or decrease in organic-matter content if the soils are properly fertilized and if minimum tillage is used to return crop residue. Undrained soils are suited to pasture or wetland wildlife habitat.

CAPABILITY UNIT IIw–5

This unit consists of nearly level and some gently sloping, somewhat poorly drained or poorly drained, loamy soils underlain by sand.

These soils are slowly permeable or moderately permeable in the subsoil and are rapidly permeable in the substratum. The available water capacity is moderate, and natural fertility is medium.

Unless they are drained, ground water is at or near

the surface in some soils throughout the year. Undrained soils are saturated with water below a depth of 1 to 3 feet in wet periods. These soils receive runoff from adjoining areas; some are subject to ponding and to flooding in wet periods and after heavy rain.

Deep ditches can be used to lower the water table if a suitable outlet is available. Use of tile drains is questionable, but if they are installed, precautions must be taken to prevent loose sand from entering and clogging the tile lines. Diversions and grassed waterways help to intercept runoff from adjoining areas and remove it safely. Surface drainage helps to remove water and prevent ponding. Cultivation when the soil is at the proper moisture content, minimum tillage, and good crop residue management help maintain good tilth.

If drained and protected from flooding, these soils are well suited to corn, soybeans, small grains, legumes, and certain vegetable crops. Row crops can be grown year after year with no deterioration of soil tilth or decrease in organic-matter content if these soils are properly fertilized and if minimum tillage is used to return crop residue to the soil. Some undrained soils can be used for crops, but wetness often delays planting in spring and harvest in fall. Crop yields are generally lower than for drained soils, because seedbeds are difficult to prepare and root penetration is restricted. Undrained soils are suitable to pasture or wetland wildlife habitat.

CAPABILITY UNIT IIw–8

The only soil in this unit is Palms muck. This is a nearly level, very poorly drained, organic soil that has 16 to 50 inches of muck underlain by a loamy substratum.

This soil is rapidly permeable in the muck layer and moderately permeable in the substratum. The available water capacity is very high, and natural fertility is low.

Unless this soil is drained, ground water is at or near the surface throughout the year. This soil receives runoff from adjoining areas and is subject to ponding and to flooding.

Tile drainage and deep ditches can be used to lower the water table if suitable outlets are available. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained, this soil is subject to soil blowing, burning, and subsidence.

If properly drained and protected from flooding and soil blowing, this soil is well suited to corn and certain vegetable crops. Response is good to applications of fertilizer. This soil can support a large population of plants. Row crops can be grown for many years if this soil is properly fertilized and if good management practices are used, but oxidation and subsidence will eventually destroy the organic layer. Undrained soils can be used for pasture, but they are better suited to wetland wildlife habitat.

CAPABILITY UNIT IIIe–1

This unit consists of sloping, well drained and moderately well drained, loamy soils underlain by gravelly sandy loam, very gravelly sandy loam, or stratified silt, silt loam, and very fine sand.

These soils are moderately permeable. The available water capacity is moderate or high, and natural fertility is medium or high. In some areas, soils are saturated with water below a depth of 3 to more than 5 feet in wet periods. They are moderately susceptible to erosion. Many areas of cultivated soil have lost as much as 4 inches of the original surface layer through erosion.

Crop rotation, close-growing crops, contour farming, stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good management of residue help control erosion and maintain good tilth. Response is good to applications of fertilizer.

Under proper management, these soils are suited to corn, soybeans, small grains, and legumes. They are well suited to pasture.

CAPABILITY UNIT IIIe–2

The only soil in this unit is Knowles silt loam, 6 to 12 percent slopes, eroded. This is a sloping, well-drained, loamy soil underlain by dolomite.

This soil is moderately permeable. The available water capacity is moderate, and natural fertility is medium. This soil is moderately susceptible to erosion. In many areas as much as 4 inches of the original surface layer has been lost through erosion.

Crop rotation, close-growing crops, contour farming, stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good management of crop residue help control erosion and maintain good tilth.

Under proper management, this soil is suited to corn, soybeans, small grains, and legumes. It is well suited to pasture.

CAPABILITY UNIT IIIe–3

The only soil in this unit is Ritchey silt loam, 2 to 6 percent slopes, eroded. This is a gently sloping, well-drained, loamy soil underlain by dolomite.

This soil is moderately permeable. The available water capacity is low, and natural fertility is medium. The hazard of further erosion is slight to moderate. In some areas that have been cultivated as much as 4 inches of the original surface layer has been lost through erosion.

Crop rotation, contour farming, stripcropping, diversions, terraces, grassed waterways, minimum tillage, and good management of crop residue help control erosion, increase water infiltration, and maintain good tilth. This eroded soil has poor tilth, and tillage is further limited by dolomite fragments in some areas.

Because this soil has a low available water capacity, it has a limited suitability for crops, and heavy fertilization is generally not economical.

Under proper management, this soil is suited to corn, soybeans, small grains, and hay. It is also suited to pasture.

CAPABILITY UNIT IIIe–4

This unit consists of nearly level and gently sloping, well drained or somewhat excessively drained, sandy and loamy soils underlain by gravelly sandy loam, gravelly loamy sand, or silty clay.

These soils are mostly moderately permeable or moderately rapidly permeable, but those that are underlain by silty clay are rapidly permeable in the upper part of the subsoil and slowly permeable in the lower part of the substratum. The available water capacity is moderate or low, and natural fertility is medium or low. These soils are slightly susceptible to erosion. In some areas that have been cultivated, as much as 4 inches of the original surface layer has been lost through erosion. The soils are also susceptible to soil blowing.

Crop rotation, close-growing crops, contour farming, stripcropping, diversions, terraces, windbreaks, minimum tillage, and good management of crop residue help control erosion and soil blowing and maintain the available water supply and organic-matter content. The soils that have a low available water capacity have a limited suitability for crops, and heavy fertilization is not generally economical.

Under proper management, these soils are suited to corn, soybeans, small grains, and hay. They are also suited to pasture.

CAPABILITY UNIT IIIe–7

This unit consists of mainly sloping and some moderately steep, well drained and somewhat excessively drained, sandy soils that have a loamy subsoil underlain by stratified sand and gravel, gravelly sandy loam, sand, or sandstone bedrock.

These soils are moderately rapidly permeable or moderately permeable. The available water capacity is moderate or low, and natural fertility is medium or low. The soils are moderately susceptible to erosion. In many areas that have been cultivated, as much as 4 inches of the original surface layer has been lost through erosion. These soils are also subject to soil blowing.

Crop rotation, close-growing crops, contour farming, stripcropping, diversions, terraces, windbreaks, minimum tillage, and good management of crop residue help control erosion and soil blowing and maintain the available water supply and organic-matter content. The soils that have a low available water capacity have a limited suitability for crops, and heavy fertilization is not generally economical.

Under proper management, these soils are suited to corn, soybeans, small grains, and hay. They are also suited to pasture.

CAPABILITY UNIT IIIw–6

This unit consists mainly of nearly level and gently sloping, poorly drained, sandy soils underlain by loamy or clayey deposits.

These soils are rapidly permeable in the upper part and moderately permeable or slowly permeable in the lower part. The available water capacity is moderate, and natural fertility is low.

Unless these soils are drained, ground water is at or near the surface in many areas throughout the year. Undrained soils are saturated with water below a depth of 1 to 3 feet during wet seasons. The soils receive runoff from adjoining areas; some are subject to ponding and to flooding.

Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. If tile drains are installed, precautions must be taken to prevent loose sand from entering and clogging the tile lines. If tile is placed in a slowly permeable, clayey substratum, backfilling with porous material can help the tile to function. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained, these soils are subject to soil blowing.

If drained and protected from flooding and ponding, these soils are suited to corn, soybeans, small grains, and legumes. Row crops can be grown year after year with no deterioration of soil tilth or decrease in organic-matter content if the soils are properly fertilized and if minimum tillage is used to return crop residue to the soil. Undrained gently sloping soils can be used for crops, but wetness may delay planting in spring and harvesting in fall. Because the root zone is shallow as a result of seasonal saturation, crop yields generally are considerably lower than on drained soils. Undrained soils are suited to pasture or wildlife habitat.

CAPABILITY UNIT IIIw–8

The only soil in this unit is Willette muck. This is a nearly level, very poorly drained, organic soil that has 16 to 50 inches of muck underlain by a clayey substratum.

This soil is rapidly permeable in the muck layer and slowly permeable in the substratum. The available water capacity is very high, and natural fertility is low. Unless this soil is drained, ground water is at or near the surface throughout the year. The soil receives runoff from adjoining areas; it is subject to ponding and flooding.

Tile drainage and deep ditches can be used to lower the water table if suitable outlets are available. If tile drainage is used, the tile should be placed in the organic material if possible. If it must be placed in the slowly permeable substratum, backfilling with porous material helps the tile to function. Diversions and grassed waterways help intercept and safely remove runoff received from adjoining areas. Surface drains help to remove water and prevent ponding. If drained, this soil is subject to soil blowing, burning, and subsidence.

If properly drained and protected from flooding and soil blowing, the soil is well suited to corn and certain vegetable crops. Response is good to applications of fertilizer. This soil can support a large population of plants. It can be used for row crops for many years if properly fertilized and if good management practices are used, but oxidation and subsidence will eventually destroy the organic layer. Undrained areas can be used for pasture, but they are better suited to wetland wildlife habitat.

CAPABILITY UNIT IIIw–9

The only soil in this unit is Houghton muck. This is a nearly level, very poorly drained, organic soil that has more than 51 inches of muck.

This soil is rapidly permeable. The available water capacity is very high, and natural fertility is low. Unless the soil is drained, ground water is at or near the surface throughout the year. Runoff is received

from adjoining areas. Some areas are subject to ponding and flooding.

Tile drainage and deep ditches can be used to lower the water table if a suitable outlet is available. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained, this soil is subject to soil blowing, burning, and subsidence. If the water table is lowered excessively, subsidence is rapid.

If properly drained and protected from flooding and soil blowing, this soil is well suited to corn and certain vegetable crops. Response is good to applications of fertilizer. This soil can support a large population of plants. It can be used for row crops for many years if properly fertilized and if good management practices are used, but oxidation and subsidence will continue to thin the organic layer. Undrained areas can be used for pasture, but are more suitable for wetland wildlife habitat.

CAPABILITY UNIT IIIs–4

This unit consists of nearly level and gently sloping, well drained and somewhat excessively drained, sandy soils that have a loamy subsoil underlain by stratified sandstone bedrock.

These soils are moderately rapidly permeable or moderately permeable. The available water capacity is moderate or low, and natural fertility is medium or low. The soils are subject to soil blowing. The gently sloping soils are slightly susceptible to erosion.

Close-growing crops, stripcropping, windbreaks, minimum tillage, and good management of crop residue and cover crops help control erosion and soil blowing and maintain the available water supply and organic-matter content. The soils that have a low available water capacity have a limited suitability for crops, and heavy fertilization is not generally economical.

The soils are suited to row crops, small grains, hay, and pasture. They are suited to irrigation. If irrigated, they are suited to production of truck crops.

CAPABILITY UNIT IVe–1

This unit consists of moderately steep, well-drained, loamy soils underlain by gravelly sandy loam, very gravelly sandy loam, or stratified silt, silt loam, and very fine sand.

These soils are moderately permeable. The available water capacity is moderate or high, and natural fertility is medium or high. These soils are highly susceptible to erosion. Tillage is difficult because of slope and the poor tilth in eroded areas. In some areas that have been cultivated, as much as 6 inches of the original surface layer has been lost through erosion.

Crop rotation, close-growing crops, contour farming, stripcropping, diversions, grassed waterways, minimum tillage, and good management of crop residue help control erosion and maintain good tilth. Response is good to applications of fertilizer.

These soils are not well suited to row crops, but with proper management they are suited to small grains, legumes, and some corn or soybeans. They are suited to pasture.

CAPABILITY UNIT IVe–2

The only soil in this unit is Knowles silt loam, 12 to 20 percent slopes, eroded. This is a moderately steep, well-drained, loamy soil underlain by dolomite.

This soil is moderately permeable. The available water capacity is moderate, and natural fertility is medium. The soil is highly susceptible to erosion. In some areas that have been cultivated up to 4 inches of the original surface layer has been lost through erosion. Tillage is difficult because of slope and because eroded areas have poor tilth.

Crop rotation, close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of crop residue help control erosion, increase infiltration, and maintain good tilth.

This soil is not well suited to row crops, but with proper management it is suited to small grains, legumes, and some corn or soybeans. It is suited to pasture.

CAPABILITY UNIT IVe–3

The only soil in this unit is Ritchey silt loam, 6 to 12 percent slopes, eroded. This is a sloping, well-drained, loamy soil underlain by dolomite.

This soil is moderately permeable. The available water capacity is low, and natural fertility is medium. The soil is moderately susceptible to erosion. In most areas that have been cultivated, as much as 4 inches of the original surface layer has been lost through erosion. The eroded areas have poor tilth, and tillage is further limited by dolomite fragments in some areas.

Crop rotation, close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of crop residue help control erosion and maintain good tilth. The low available water capacity limits suitability of the soil for crops, and heavy fertilization is not generally economical.

This soil is not well suited to row crops, but with proper management it is suited to small grains, hay, and some corn or soybeans. It is suited to pasture.

CAPABILITY UNIT IVe–4

This unit consists of sloping, well drained and somewhat excessively drained, sandy and loamy soils that have a loamy subsoil underlain by gravelly sandy loam or gravelly loamy sand.

These soils are moderately permeable or moderately rapidly permeable. The available water capacity is moderate, and natural fertility is medium. The soils are moderately susceptible to erosion. In many cultivated areas as much as 4 inches of the original surface layer has been lost through erosion.

Crop rotation, close-growing crops, contour farming, stripcropping, grassed waterways, minimum tillage, and good management of crop residue help control erosion and maintain good tilth. Response is good to applications of fertilizer.

These soils are not well suited to row crops, but with proper management they are suited to small grains, hay, and some corn or soybeans. They are suited to pasture.

CAPABILITY UNIT IVe–7

This unit consists of moderately steep and some

steep, well drained and somewhat excessively drained, sandy soils that have a loamy subsoil underlain by stratified sand and gravel or by sandstone bedrock.

These soils are moderately rapidly permeable. The available water capacity is moderate or low, and natural fertility is low. The soils are subject to soil blowing. They are severely susceptible to erosion. In many areas that have been cultivated as much as 6 inches of the original surface layer has been lost through erosion.

Crop rotation, close-growing crops, contour farming, stripcropping, windbreaks, minimum tillage, and good management of residue help control erosion and soil blowing and maintain the available water capacity and organic-matter content. The soils that have a low available water capacity have a limited suitability for crops, and heavy fertilization is not generally economical.

These soils are not well suited to row crops, but with proper management they are suited to small grains, legumes, and some corn or soybeans. They are suited to pasture.

CAPABILITY UNIT IVw–5

The only soil in this unit is Granby loamy fine sand. This is a nearly level, poorly drained, sandy soil underlain by sand.

This soil is rapidly permeable. The available water capacity is low, and natural fertility is low. Unless the soil is drained, ground water is at or near the surface throughout the year. Runoff is received from adjoining areas; many areas are subject to flooding and to ponding in wet periods and after heavy rains.

Deep ditches can be used to lower the water table if a suitable outlet is available. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. Where drained, this soil is subject to soil blowing. Where excessively drained, this soil loses the beneficial effects of free water in the lower part of the soil.

Controlled drainage, windbreaks, minimum tillage, and good management of crop residue help control soil blowing and maintain organic-matter content and available water capacity. Adequate fertilization helps control soil blowing by maintaining plant cover. This soil has a limited suitability for crops, and heavy fertilization is not generally economical. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in this sandy soil.

If adequately drained and properly managed, this soil is suited to row crops, small grains, and hay. Most areas are too wet to cultivate without artificial drainage. Undrained areas are suited to pasture or wildlife habitat.

CAPABILITY UNIT IVw–7

This unit consists of nearly level, very poorly drained, organic soils that have 16 to 50 inches of muck underlain by sand or marl.

These soils are rapidly permeable or slowly permeable in the substratum. The available water capacity is high or very high, and natural fertility is low. Unless the soils are drained, ground water is at or near the surface throughout the year. The soils receive runoff from adjoining areas; some are subject to ponding and flooding.

Deep ditches and tile drainage can be used to lower the water table if a suitable outlet is available. If tile drainage is used in the soils underlain by sand, precautions must be taken to prevent loose sand from entering and clogging the tile lines. If tile is used in the soil underlain by marl, it should be placed in the more permeable organic material if possible. If the tile must be placed in the marl, backfilling with porous material will help the tile to function. Diversions and grassed waterways help to intercept and safely remove runoff received from adjoining areas. Surface drainage helps to remove water and prevent ponding. If drained, these soils are subject to soil blowing, burning, and subsidence.

If properly drained and protected from flooding and soil blowing, the soils are suited to corn and certain vegetable crops. Response is good to applications of fertilizer. These soils can support a large population of plants. They can be used for row crops for many years if properly fertilized and if good management practices are used, but oxidation and subsidence will eventually destroy the organic layer. Undrained soils are suited to pasture, but are better suited to wetland wildlife habitat.

CAPABILITY UNIT IVs–3

This unit consists of nearly level to sloping, somewhat excessively drained and well drained and moderately well drained, sandy soils underlain by sand or by sandstone bedrock.

These soils are very rapidly permeable or rapidly permeable. The available water capacity and natural fertility are low. Some soils are saturated with water below a depth of 2 to 3 feet during wet seasons. These soils are subject to soil blowing, and sloping areas are subject to erosion.

Close-growing crops, stripcropping, windbreaks, minimum tillage, good management of crop residue, and cover crops help control soil blowing and maintain organic-matter content and available water capacity (fig. 12). Contour farming and contour stripcropping help control erosion on sloping soils. Adequate fertilization helps control soil blowing and erosion by helping to maintain plant cover. The low available water capacity limits the suitability of the soils for crops, and heavy fertilization is not generally economical. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in these sandy soils.

Under proper management, the soils are suited to row crops, small grains, and hay. The nearly level and gently sloping areas are suited to irrigation. With irrigation, the soils are suited to more intensive crop production. They are suited to pasture. Planting early in spring before the soil has a chance to dry, is best. Later plantings, especially of small seeded crops, have a poor chance of survival.

CAPABILITY UNIT Vw–14

This unit consists only of Alluvial land, wet. This nearly level, poorly drained soil consists of alluvial sediments on flood plains. Its use is limited by the

Figure 12.—**Windblown sand accumulates in fence rows and other protected areas when soil blowing occurs in an area of Gotham soils.**

meandering stream channels, oxbows, sloughs, and by frequent flooding.

The sediments are too variable to rate for permeability, natural fertility, and available water capacity. Unless they are drained, ground water is at or near the surface throughout the year. Drainage and protection from flooding are generally impractical.

Most areas are used for pasture, woodland, or wetland wildlife habitat.

CAPABILITY UNIT VIe–1

This unit consists of steep, well-drained, loamy soils underlain by gravelly sandy loam.

These soils are moderately permeable. The available water capacity is moderate, and natural fertility is medium. The soils are very highly susceptible to erosion. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain adequate plant cover and control erosion.

Because of the very severe erosion hazard, these soils are generally not suited to cultivated crops. With proper management they are suited to pasture and hay. They are used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIe–3

The only soil in this unit is Ritchey silt loam, 12 to 20 percent slopes, eroded. This moderately steep, well-drained, loamy soil is underlain by dolomite.

This soil is moderately permeable. The available water capacity is low, and natural fertility is medium. This soil is highly susceptible to erosion. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain adequate plant cover and control erosion.

Because of the severe erosion hazard, shallow root zone, and low available water capacity, this soil is generally not suited to cultivated crops. With proper management, it is suited to hay and pasture, but yields are low. It is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIe–4

The only soil in this unit is Lapeer loamy fine sand, 12 to 25 percent slopes, eroded. This is a moderately steep and steep, well-drained, loamy soil that is underlain by gravelly sandy loam.

This soil is moderately permeable. The available water capacity is moderate, and natural fertility is

medium. The soil is highly susceptible to erosion. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain adequate plant cover and control erosion.

Because of the severe erosion hazard, this soil is generally not suited to cultivated crops. With proper management, it is suited to hay and pasture. It is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIe–7

The only soil in this unit is Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes. This moderately steep, well drained and somewhat excessively drained, sandy soil has a sandy subsoil underlain by sandstone bedrock.

This soil is rapidly permeable. The available water capacity is low, and natural fertility is low. The soil is highly or very highly susceptible to erosion and is subject to soil blowing. Many areas of this soil are wooded or in pasture and have been eroded only slightly. Pasture and hay fields are difficult to renovate. Controlled grazing, renovation, and fertilization help maintain plant cover and control erosion.

Because of low available water capacity and the severe erosion hazard, this soil is generally not suited to cultivated crops. Under proper management, it is suited to hay and pasture, but yields are low. It is used mostly for woodland or wildlife habitat.

CAPABILITY UNIT VIs–3

The only soil in this unit is Oakville fine sand, 6 to 12 percent slopes. This sloping, well-drained, sandy soil is underlain by sand.

This soil is very rapidly permeable. The available water capacity is low, and natural fertility is low. This soil is moderately susceptible to erosion but is very susceptible to soil blowing. Establishing plant cover is difficult. Pasture and hay should be seeded early in spring, before the soil has a chance to dry. Later plantings are not likely to survive. Controlled grazing, renovation, and fertilization help maintain plant cover and control erosion and soil blowing. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in this sandy soil.

Because of low available water capacity and high susceptibility to soil blowing, this soil is generally not suited to cultivated crops. With proper management, it is suited to pasture and hay, but yields are low. It is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIs–5

The only soil in this unit is Rodman gravelly sandy loam, 6 to 20 percent slopes. This gently sloping to moderately steep, excessively drained, loamy soil is underlain by stratified sand and gravel.

This soil is very rapidly permeable. The available water capacity is very low, and natural fertility is low. The soil is highly susceptible to erosion. In many areas that have been cultivated, as much as 4 inches of the original surface layer has been lost through erosion. In most areas the surface layer is gravelly. Most areas are in pasture or woodland and have been eroded only slightly. Controlled grazing, renovation, and fertilization help maintain plant cover and control erosion.

Because of very low available water capacity, erosion hazard, and gravelly surface layer, this soil is generally not suited to cultivated crops. With proper management, it is suited to hay and pasture, but yields are low. It is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIIs–3

The only soil in this unit is Oakville fine sand, 12 to 35 percent slopes. This moderately steep to very steep, well-drained, sandy soil is underlain by sand.

This soil is rapidly permeable. The available water capacity is low, and natural fertility is low. The soil is highly and very highly susceptible to erosion and is very susceptible to soil blowing. Establishing plant cover is difficult. Controlled grazing and topdressing with fertilizer help maintain plant cover and control erosion and soil blowing. Pollution of ground water by leaching of fertilizer elements, especially nitrates, is a danger in this sandy soil.

Because of low available water capacity, the severe and very severe hazard of erosion, and high susceptibility to soil blowing, this soil is not suited to cultivated crops. With proper management, it is suited to pasture, but yields are low. Improved pasture is difficult to establish and maintain. Many pasture areas are in native bluegrass. This soil is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIIs–5

The only soil in this unit is Rodman gravelly sandy loam, 20 to 35 percent slopes. This steep and very steep, excessively drained, loamy soil is underlain by stratified sand and gravel.

This soil is rapidly permeable. The available water capacity is very low, and natural fertility is low. The soil is very highly susceptible to erosion. Some areas that have been grazed are eroded. Controlled grazing and topdressing with fertilizer help maintain plant cover and control erosion. Most areas are gravelly.

Because of very low available water capacity, a shallow root zone, gravelly texture, and a very severe hazard of erosion, this soil is not suited to cultivated crops. With proper management, some of the less sloping areas are suited to pasture, but yields are low. Improved pasture is difficult to establish and maintain. Many pasture areas are in native bluegrass. This soil is used mostly for woodland and wildlife habitat.

CAPABILITY UNIT VIIIw–15

This unit consists only of Marsh. It is a very poorly drained soil in depressions and in areas bordering lakes and rivers. These areas are flooded most of the year. They are covered by cattails, bulrushes, and other plants that grow in shallow water.

Marsh is too wet for common farm crops and pasture. It is generally not suited to drainage because it lacks suitable outlets. Marsh is suited to the production of wetland wildlife food and cover. In dry seasons these wetlands need protection from grazing. Areas that have completely filled with sediments or that are entirely overgrown with cattails can be blasted out with dynamite to form potholes for waterfowl and other wildlife. In dry seasons these areas need protection from fire.

CAPABILITY UNIT VIIIs–10

This unit consists of sloping to very steep soils and rock outcrop. Some areas consist of 30 to 75 percent bedrock outcrops that are dominantly dolomite, but small areas are sandstone. Other areas are more than 90 percent igneous bedrock outcrop.

This unit is too variable to rate for permeability, available water capacity, and natural fertility. Sloping areas are moderately susceptible to erosion; moderately steep areas are highly susceptible to erosion; and steep and very steep areas are very highly susceptible to erosion.

Because of its rocky nature, this unit is not suited to cultivation, pasture, or woodland management. Areas are used mostly for wildlife habitat or recreation.

Predicted yields

Table 2 gives predicted average yields per acre for the main crops grown in Green Lake County. Predictions are based on results obtained by the agricultural experiment station on experimental test plots and on observations made by soil scientists and other agricultural workers who are familiar with the soils (*3*). All yields are averages based on amounts obtained over a long period of time and assume an average amount of rainfall.

By using improved crop varieties and management, higher yields than those shown in the table are being obtained by many farmers. This trend can be expected to continue. This table will continue to have value as the general level of crop yields increases because it also gives an idea of the relative productivity of the soils. Improvements in technology in the future, however, may affect some soils more than others. Also, some soils that have low to medium yields because they have low available water capacity, may be well suited to intensive production of specialty crops if irrigated (fig. 13).

The management needed to obtain the yields shown in table 2 is considerably above average for the county. Under this level of management, acid soils are limed to about pH 6.5, according to recommendations resulting from soil tests. Fertilizer is also applied according to these recommendations. Adequate surface or internal drainage is provided, and soils are protected from flooding if necessary. Seedbed preparation is adequate and timely. Proper planting methods are used. Harvesting of crops is timely and carefully performed. Necessary

Figure 13.—**Alfalfa growth trails in an area of Plano soils.**

TABLE 2.—*Predicted average yield per acre of principal crops*

[These yields are those obtained under an improved or high level of management. Absence of a yield figure indicates that the soil is not suited to the crop, or that the crop is not ordinarily grown on the soil]

Soil	Corn		Oats [1]	Alfalfa-brome hay [2] (dry weight)	Sweet corn	Early June peas	Sweet peas
	Grain	Silage					
	Bu	*Tons*	*Bu*	*Tons*	*Tons*	*Lbs*	*Lbs*
Adrian muck [3]	90	15			3.7		
Alluvial land, wet [4]							
Barry loam [3]	115	19	65	4.0	4.2		
Boyer loamy fine sand, 1 to 6 percent slopes	70	11	50	2.5	2.9	1,500	1,800
Boyer loamy fine sand, 6 to 12 percent slopes, eroded	65	11	50	2.0	2.7	1,410	1,690
Boyer loamy fine sand, 12 to 25 percent slopes	55	9	45	2.0	2.3	1,200	1,440
Brems loamy fine sand, 0 to 6 percent slopes	60	10	40	2.3	2.2		
Briggsville silt loam, 0 to 2 percent slopes	100	17	70	4.5	4.0	1,600	2,130
Briggsville silt loam, 2 to 6 percent slopes	90	17	70	4.0	4.0	1,700	2,250
Colwood silt loam [3]	95	16	60	4.0	4.0		
Dodge silt loam, 2 to 6 percent slopes	115	17	75	4.5	4.2	1,700	2,250
Dodge silt loam, 6 to 12 percent slopes, eroded	100	16	60	4.0	4.0	1,600	2,100
Edwards muck [3]	80	13			3.5		
Friesland loam, 0 to 2 percent slopes	110	18	75	4.5	4.5	2,350	2,850
Friesland loam, 2 to 6 percent slopes	110	18	75	4.0	4.5	2,500	3,000
Gotham loamy fine sand, 1 to 6 percent slopes	60	10	50	2.5	2.0		
Gotham loamy fine sand, 6 to 12 percent slopes	60	10	50	2.2	1.9		
Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes	60	10	50	2.2	1.9		
Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes				1.5			
Granby loamy fine sand [3]	70	12	55	3.3	2.5		
Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes [3]	80	13	60	3.5	2.5		
Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes [3]	80	13	60	3.5	2.5		
Grellton fine sandy loam, 0 to 2 percent slopes	105	18	70	4.0	4.5	2,350	2,850
Grellton fine sandy loam, 2 to 6 percent slopes	105	18	70	4.0	4.5	2,500	3,000
Grellton fine sandy loam, 6 to 12 percent slopes, eroded	90	15	65	3.5	4.2	2,300	2,750
Grellton fine sandy loam, 12 to 20 percent slopes, eroded	70	11	50	2.5	3.6	2,000	2,400
Griswold silt loam, 0 to 2 percent slopes	105	18	70	4.0	4.2	2,350	2,850
Griswold silt loam, 2 to 6 percent slopes	95	16	70	4.0	4.2	2,500	3,000
Griswold silt loam, 6 to 12 percent slopes, eroded	90	15	65	3.5	3.9	2,300	2,750
Houghton muck [3]	95	16			4.0		
Joy silt loam, 0 to 3 percent slopes [3]	130	21	75	5.0	5.0		
Kibbie loam, 0 to 3 percent slopes [3]	105	18	70	4.5	4.2		
Kidder fine sandy loam, 0 to 2 percent slopes	95	16	65	3.7	3.9	1,615	2,130
Kidder fine sandy loam, 2 to 6 percent slopes	95	15	65	3.5	3.9	1,700	2,250
Kidder fine sandy loam, 6 to 12 percent slopes, eroded	80	13	60	3.0	3.7	1,600	2,115
Kidder fine sandy loam, 12 to 20 percent slopes, eroded	70	11	55	2.5	3.1	1,360	1,845
Kidder loam, 0 to 2 percent slopes	100	17	70	4.0	4.0	1,615	2,130
Kidder loam, 2 to 6 percent slopes	100	15	70	4.0	4.0	1,700	2,250
Kidder loam, 6 to 12 percent slopes, eroded	85	14	65	3.5	3.8	1,600	2,115
Kidder loam, 12 to 20 percent slopes, eroded	75	12	60	3.0	3.2	1,360	1,845
Kidder loam, 20 to 30 percent slopes				2.0			
Knowles silt loam, 0 to 2 percent slopes	105	18	70	3.5	4.2	1,615	2,130
Knowles silt loam, 2 to 6 percent slopes	100	17	70	3.5	4.2	1,700	2,250
Knowles silt loam, 6 to 12 percent slopes, eroded	90	15	65	3.0	3.9	1,600	2,115
Knowles silt loam, 12 to 20 percent slopes, eroded	80	13	60	3.0	3.4	1,360	1,845
Lapeer loamy fine sand, 2 to 6 percent slopes	75	12	55	2.5	3.5	1,600	1,900
Lapeer loamy fine sand, 6 to 12 percent slopes, eroded	70	11	50	2.5	3.2	1,500	1,785
Lapeer loamy fine sand, 12 to 25 percent slopes, eroded							
Lapeer fine sandy loam, 0 to 2 percent slopes	85	14	65	3.5	3.5	1,520	1,800
LeRoy silt loam, 6 to 12 percent slopes, eroded	85	13	60	4.0	3.2	1,500	1,900
LeRoy silt loam, 12 to 20 percent slopes, eroded	75	12	55	3.5	3.0	1,250	1,400
Lomira silt loam, 2 to 6 percent slopes	100	17	65	4.5	4.0	2,350	2,850
Lomira silt loam, 6 to 12 percent slopes, eroded	90	15	60	4.0	3.8	2,500	3,000

TABLE 2.—*Predicted average yield per acre of principal crops*—Continued

Soil	Corn		Oats [1]	Alfalfa-brome hay [2] (dry weight)	Sweet corn	Early June peas	Sweet peas
	Grain	Silage					
	Bu	*Tons*	*Bu*	*Tons*	*Tons*	*Lbs*	*Lbs*
Lomira silt loam, 12 to 20 percent slopes, eroded	70	11	50	3.0	3.2	2,300	2,750
Manawa silt loam, 0 to 3 percent slopes [3]	90	15	70	4.5	3.8		
Marcellon loam, 0 to 3 percent slopes [3]	115	19	75	4.5	4.3		
Markesan silt loam, 2 to 6 percent slopes, eroded	85	14	60	3.0	3.3	1,700	2,250
Markesan silt loam, 6 to 12 percent slopes, eroded	80	13	55	3.0	3.0	1,590	2,115
Markesan silt loam, 12 to 20 percent slopes, eroded	70	11	50	2.5	2.9	1,360	1,800
Marsh [4]							
Marshan silt loam [3]	100	17	65	3.5	4.0		
Mecan loamy fine sand, 2 to 6 percent slopes	75	12	60	3.0	3.5	1.600	1,900
Mecan loamy fine sand, 6 to 12 percent slopes, eroded	70	11	55	3.0	3.3	1,500	1,780
Mendota silt loam, 0 to 2 percent slopes	120	20	80	5.0	4.3	2,350	2,850
Mendota silt loam, 2 to 6 percent slopes	110	19	80	5.0	4.2	2,500	3,000
Mendota silt loam, 6 to 12 percent slopes, eroded	100	18	70	4.5	3.9	2,300	2,750
Oakville fine sand, 1 to 6 percent slopes	55	9	45	2.5	1.9		
Oakville fine sand, 6 to 12 percent slopes				2.0			
Oakville fine sand, 12 to 35 percent slopes							
Okee loamy fine sand, 1 to 6 percent slopes	75	12	60	3.5	3.0	1,400	1,700
Okee loamy fine sand, 6 to 15 percent slopes	70	11	50	3.0	3.0	1,300	1,600
Oshtemo loamy fine sand, 1 to 6 percent slopes	70	11	50	2.3	2.9	1,500	1,800
Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded	60	10	45	2.0	2.7	1,410	1,690
Ossian silt loam [3]	115	19	75	4.5	4.3		
Palms muck [3]	105	18			4.1		
Plano silt loam, 0 to 2 percent slopes	130	21	80	5.0	5.1	2,350	2,850
Plano silt loam, 2 to 6 percent slopes	125	20	75	5.0	5.1	2,500	3,000
Poy silty clay loam [3]	90	15	65	4.0	3.8		
Poygan silty clay loam [3]	100	17	65	4.0	4.0		
Richford loamy sand, 1 to 6 percent slopes	55	9	50	2.5	2.1	1,400	1,700
Richford loamy sand, 6 to 15 percent slopes	50	8	40	2.0	1.9	1,300	1,600
Ripon silt loam, 1 to 6 percent slopes	85	14	70	3.5	3.5	1,700	2,250
Ritchey silt loam, 2 to 6 percent slopes, eroded	70	11	55	3.0	2.9	1,400	1,600
Ritchey silt loam, 6 to 12 percent slopes, eroded	65	11	50	2.5	2.7	1,300	1,500
Ritchey silt loam, 12 to 20 percent slopes, eroded				1.5			
Rock land and Ritchey soils, 6 to 45 percent slopes [4]							
Rock outcrop [4]							
Rodman gravelly sandy loam, 6 to 20 percent slopes				1.0			
Rodman gravelly sandy loam, 20 to 35 percent slopes							
Rotamer sandy loam, 2 to 6 percent slopes, eroded	80	13	60	4.0	3.8	1,600	1,900
Rotamer sandy loam, 6 to 12 percent slopes, eroded	70	11	50	3.5	3.6	1,500	1,780
Rotamer sandy loam, 12 to 20 percent slopes, eroded	60	10	40	3.0	3.1	1,400	1,520
Rotamer sandy loam, 20 to 30 percent slopes			30	2.0			
St. Charles silt loam, 0 to 2 percent slopes	115	19	70	5.0	5.0	2,350	2,850
St. Charles silt loam, 2 to 6 percent slopes	110	18	65	4.5	5.0	2,500	3,000
St. Charles silt loam, 6 to 12 percent slopes, eroded	100	17	60	4.0	4.1	2,300	2,750
Sisson loam, 2 to 6 percent slopes	105	18	70	4.0	4.1	1,700	2,250
Sisson loam, 6 to 12 percent slopes, eroded	90	15	65	3.5	3.8	1,600	2,115
Sisson loam, 12 to 20 percent slopes, eroded	80	13	60	3.0	3.3	1,360	1,800
Tustin loamy fine sand, 1 to 6 percent slopes	70	11	50	2.5	3.0	1,400	1,700
Urne loamy fine sand, 2 to 6 percent slopes	80	13	65	3.0	3.0	1,300	1,600
Urne loamy fine sand, 6 to 12 percent slopes, eroded	75	12	60	2.5	2.8	1,120	1,500
Urne loamy fine sand, 12 to 30 percent slopes, eroded	60	10	45	2.0	2.4	1,040	1,280
Willette muck [3]	80	13			4.0		
Zittau silty clay loam, 0 to 3 percent slopes [3]	90	15	65	4.0	3.9		

[1] Yields are for oats that are seeded with a grass-legume mixture. Higher yields may be obtained, but a poorer stand of legume-grass seeding generally should be expected.

[2] Yields are for hay that is cut during the first or second years after the stand is adequately established.

[3] Yields are for areas of this soil that are protected from flooding or ponding.

[4] Land types are too variable to predict yields.

erosion control practices are installed and maintained. Cropping systems are suitable for the soil and slope. Annual and perennial weeds are controlled by timely use of mechanical and chemical methods. Insects that damage crops are controlled.

Peas and sweet corn are commonly grown in Green Lake County and are processed at several canning factories in the area. Yields given for these crops in table 2 are the average yields obtained over a period of approximately 15 years without irrigation. These yields include the extra-early and extra-late season plantings made to increase canning factory efficiency and are not the highest yields possible. Because peas are very sensitive to soil wetness, the yields on nearly level soils are slightly less than on gently sloping soils. Peas and sweet corn are not generally grown on soils that have more than 15 percent slope. Yields listed for moderately steep soils are for 12 to 15 percent slopes.

Woodland [2]

Before settlement, most of Green Lake County was covered by a stand of open-grown timber. Intermingled with the trees were prairie grasses: big bluestem, little bluestem, indiangrass, and switchgrass. In most of the timbered area the dominant tree was oak. Other hardwoods grew in some areas, and jack pine grew in open stands in some areas of sandy soils.

A fairly extensive area in the southeastern corner of the county was a nearly treeless tall-grass prairie in which big and little bluegrass, indiangrass, and switchgrass were dominant. Some low-lying wet areas consisted of lowland hardwood timber and occasional open areas of sedge-bluejoint grass-cordgrass marsh vegetation (*5*).

With the coming of farming, most of the open prairie was plowed for crops. The control of fires favored growth of hardwood trees other than oak. Most other woodlands are small scattered tracts, which are not managed for timber production (fig. 14).

In a 1968 inventory of the forest resources, 27,700 acres was in commercial forest, about 12 percent of the land area (*25*). Almost all of this is small, privately owned tracts, mostly farm woodlots. The forest is 40 percent oak and hickory; 25 percent maple, beech, and birch; 15 percent elm, ash, and cottonwood; 9 percent aspen and birch; 6 percent conifers; and the rest is not stocked.

Much of the land once farmed has been planted to red pine, white pine, and jack pine. These plantings help conserve soil and water as well as provide wildlife habitat and add to the esthetic value of the land. The plantings have been especially important on sandy soils such as Brems, Boyer, Gotham, Oakville, Okee, and Oshtemo soils.

The soils of Green Lake County have been placed in 26 woodland suitability groups to assist owners in planning the use of their soils for wood crops. In table 3, the soils of each woodland suitability group are rated for woodland use and management.

The first column in table 3 gives the woodland suitability groups in the county and the soils in each group. Each group is made up of soils that are suited to the same kinds of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity. Each woodland suitability group is identified by a three-part symbol, such as "2o1" or "3r1."

Figure 14.—**Mixed hardwood trees in an area of Lomira soils. This woodlot is protected from burning and cattle grazing.**

The first part of the symbol indicates the relative productivity of the soils: 1 is high, 2 is moderately high, 3 is moderate, 4 is moderately low, 5 is low, and 6 is not productive.

The second part of the symbol, a letter, indicates the subclass and an imporatant soil property that imposes a slight to severe limitation in managing the soils for wood production. Definitions of the subclasses follow:

Subclass w (excessive wetness). Soils in which excessive water, either seasonally or yearlong, causes significant limitations for woodland use or management. These soils have restricted drainage, high water tables, or are subject to flooding, which adversely affect either stand development or management.

Subclass d (restricted rooting depth). Soils that are restricted or limited for woodland use or management because root penetration is restricted. Soils shallow to hard rock, hardpan, or

[2] By GEORGE W. ALLEY, forester, Soil Conservation Service, at Madison.

TABLE 3.—*Woodland*

Woodland groups and map symbols [1]	Potential productivity of the soils				Trees to select for planting	Equipment limitations	Erosion hazard	Seedling mortality
	Kind of trees	Average site index	Number of plots	Yearly growth per acre				
				Bd ft				
Group 1w1: Co	Red oak	79	2	310	Silver maple, red maple, green ash, white ash, and white spruce.	Severe	Slight	Moderate.
	Red maple	76	2	170				
	Silver maple	80	2	190				
	Green ash	81	2	300				
Group 1o1: GnA, GnB, GnC2, ScA, ScB, ScC2, SnB, SnC2.	Sugar maple	65	1	105	Eastern white pine, red pine, and white spruce.	Slight	Slight	Slight.
	Red oak	66	3	225				
	White ash	75	1	----------				
	Black cherry	74	2	----------				
Group 1r1: GnD2, SnD2.	Sugar maple	65	[2]	105	Eastern white pine, red pine, and white spruce.	Moderate	Moderate	Slight on north- and east-facing slopes; moderate on south- and west-facing slopes.
	Red oak	66	[2]	225				
Group 1o2: KbA	Sugar maple	67	1	110	Eastern white pine, white spruce, and red pine.	Slight	Slight	Slight.
	Red oak	70	[2]	250				
Group 2w1: Pr, Py	Silver maple	86	[2]	220	White spruce, red maple, silver maple, white ash, and green ash.	Severe	Slight	Moderate to severe.
	Red maple	70	[2]	140				
	White ash	70	[2]	----------				
	Green ash	70	[2]	----------				
	Swamp white oak.	68	[2]	240				
Group 2c1: BsA, BsB.	Northern red oak.	62	1	195	Red pine, eastern white pine, and white spruce.	Slight	Slight	Slight.
	Sugar maple	49	1	60				
	Basswood	65	[2]	----------				
	White ash	65	[2]	----------				
Group 2c2: MaA	Sugar maple	58	1	90	Eastern white pine, red pine, and white spruce.	Slight	Slight	Slight.
	White ash	70	[2]	----------				
	Green ash	70	[2]	----------				
Group 2s1: OkB, OkC.	Jack pine	65	[2]	120	Red pine, eastern white pine, and jack pine.	Slight	Slight	Moderate.
	Red oak	65	[2]	220				
Group 2o1: DdB, DdC2, KdA, KdB, KdC2, KeA, KeB, KeC2, KwA, KwB, KwC2 LrC2, LvB, LvC2, McA.	Red oak	60 ± 9.1	14	190	Red pine, eastern white pine, and white spruce.	Slight	Slight	Slight.
	Sugar maple	54	4	75				
	White oak	53	2	150				
	White ash	72	2	----------				
Group 2r1: KdD2, KeD2, KeE, KwD2, LrD2, LvD2.	Red oak	60	[2]	190	Red pine, eastern white pine, and white spruce.	Moderate	Moderate	Slight on north- and east-facing slopes; moderate on south- and west-facing slopes.
	Sugar maple	54	[2]	75				
	White oak	53	[2]	150				
	White ash	72	[2]	----------				
Group 3d1: RhB2, RhC2.	Red oak	55	[2]	160	Red pine, eastern white pine, jack pine.	Slight	Slight	Slight.
	Black oak	55	[2]	160				

TABLE 3.—*Woodland*—Continued

Woodland groups and map symbols [1]	Potential productivity of the soils				Trees to select for planting	Equipment limitations	Erosion hazard	Seedling mortality
	Kind of trees	Average site index	Number of plots	Yearly growth per acre				
				Bd ft				
Group 3d2: RhD2	Red oak	55	[2]	160	Red pine, eastern white pine, and jack pine.	Moderate	Severe	Slight on north- and east-facing slopes; moderate on south- and west-facing slopes.
	Black oak	55	[2]	160				
Group 3c2: Z+A	Red oak	55	[2]	160	Eastern white pine, white spruce, and red pine.	Slight	Slight	Slight.
	Red maple	55	[2]	----------				
	White ash	55	[2]	----------				
Group 3s1: BrB, GaB, GaC, GbC, OaB, OaC.	Red oak [3]	57	2	180	Red pine, jack pine, and eastern white pine.	Slight	Slight	Moderate.
	White oak	47	1	115				
	White pine	52	2	230				
	Red pine	43	1	160				
	Jack pine	50	1	60				
Group 3s3: GbD, OaD.	Red oak [3]	57	[2]	180	Red pine, jack pine, and eastern white pine.	Severe	Severe	Moderate.
	White oak	47	[2]	115				
	White pine	52	[2]	230				
	Red pine	43	[2]	160				
	Jack pine	50	[2]	60				
Group 3o1: BpB, BpC2, LaB, LaC2, Lb, MnB, MnC2, OmB, OmC2, RaB, RaC, TuB, UrB, UrC2.	Red oak [3]	59 ± 7.7	7	185	Eastern white pine, red pine, and white spruce.	Slight	Slight	Slight.
	White pine	61	1	400				
	Red pine	55	1	300				
	White oak	52	1	140				
Group 3r1: BpD, LaD2, UrD2.	Red oak [3]	59	[2]	185	Eastern white pine, red pine, and white spruce.	Moderate	Moderate	Slight on north- and east-facing slopes; moderate on south- and west-facing slopes.
	White pine	61	[2]	400				
	Red pine	55	[2]	300				
	White oak	52	[2]	140				
Group 3w1: Gf, GhA, GkA.	Red maple	65	1	115	Eastern white pine, white spruce, red maple, silver maple, white ash, and green ash.	Severe	Slight	Moderate to severe.
	Green ash	66	1	----------				
	White pine	58	2	370				
Group 3w2: Os	Red maple	60	[2]	90	White spruce, red maple, silver maple, white ash, and green ash.	Severe	Slight	Moderate to severe.
	Green ash	60	[2]	----------				

TABLE 3.—*Woodland*—Continued

Woodland groups and map symbols [1]	Potential productivity of the soils				Trees to select for planting	Equipment limitations	Erosion hazard	Seedling mortality
	Kind of trees	Average site index	Number of plots	Yearly growth per acre				
				Bd ft				
Group 3w3: Ad, Ed, Ho, Pa, We.	Tamarack	48	4	95	Unsuitable for planting.	Severe	Slight	Slight.
	Northern white-cedar.	35	1	50				
	Red maple	65	1	120				
	Silver maple	92	2	240				
	Tree growth on these soils is usually limited to tamarack, northern white-cedar, willows, or elm. Occasionally silver maple, red maple, white ash or green ash become established and make rapid growth.							
Group 4w2: An, Bb, Mh.	Silver maple	70	[2]	140	White spruce, red maple, silver maple, white ash, and green ash.	Severe	Slight	Moderate to severe.
	Red maple	50	[2]	50				
	White ash	50	[2]					
Group 4f2: RsD, RsE.	Red oak [3]	43	2	95	Red pine, jack pine, and eastern redcedar.	Moderate	Severe	Moderate on north- and east-facing slopes; severe on south- and west-facing slopes.
Group 4o1: JoA	Red oak	45	[2]	100	Eastern white pine, white spruce, and red pine.	Slight	Slight	Slight.
	Red maple	45	[2]	50				
Group 6w1: Mf. These soils are not suited to woodland management.								
Group 6s1: RkE, Ro. These soils are not suited to woodland management.								

[1] These soils are generally used for producing farm crops and are not naturally forested: FoA, FoB, GrA, GrB, GrC2, MdB2, MdC2, MdD2, MsA, MsB, MsC2, PnA, PnB, ReB, RtB2, RtC2, RtD2 and RtE.

[2] Data estimated for this kind of tree.

[3] The data are also estimates for northern red oak, black oak, and northern pin oak.

other layers in the soil that restrict roots are examples.

Subclass c (clayey soils). Soils that are restricted or limited for woodland use or management because of the kind or amount of clay in the upper part of the soil profile.

Subclass s (sandy soils). Dry sandy soils that have little or no clay in the subsoil and that have moderate to severe restrictions or limitations for woodland use or management. The use of equipment is limited, or these soils have low available water capacity and normally are low in available plant nutrients.

Subclass f (fragmental or skeletal soils). Soils that are restricted or limited for woodland use or management because they contain large amounts of coarse fragments more than 2 millimeters and less than 10 inches in diameter. Flaggy soils are included.

Subclass r (relief or slope steepness). Soils that are restricted or limited for woodland use or management only by steepness of slope.

Subclass o (slight or no limitations). Soils that have no significant restrictions or limitations for woodland use or management.

The third part of the symbol, a number, identifies the woodland group. All soils in a group have similar management problems and productivity and are generally suitable for the same kinds of trees, either pines, hardwood, or both.

The kinds of trees that are adapted to the soil are presented in the "Potential productivity of the soils" columns. These are the trees which woodland managers generally favor in intermediate or improvement cuttings.

The third column gives the site index. The site index is the average height of the dominant and codominant trees in a stand at age 50 years. The site indices for some of the more important kinds of trees and soils have been measured; others are estimated from measurements made on similar soils and trees.

Site indices used in Green Lake County are based on recognized site index curves for silver maple and red maple (*10*), white ash and green ash (*6*), red oak (*18*), sugar maple (*6*), jack pine (*11*), red pine (*13*), white oak (*18*), northern whitecedar (*12*), and tamarack (*14*).

Annual yields for tree species were estimated from yields based on site indices for silver maple (*17*), upland oak (*18*), northern hardwoods (*16*), jack pine (*9*), and red pine (*8*).

Equipment limitations are rated on the basis of soil characteristics that restrict or prohibit the use of equipment for tending and harvesting the trees. In Green Lake County, the limiting soil characteristics are excessive soil wetness, slope, and texture of the surface layer. *Slight* means there is no restriction in the kind of equipment or in the time of year it is used; *moderate* means that use of equipment is restricted for less than 3 months of the year; and *severe* means that special equipment is needed and its use is restricted for more than 3 months of the year.

Erosion hazard refers to the potential hazard of soil losses in woodland. The hazard is *slight* if expected soil losses are small; *moderate* if some soil losses are expected and care is needed during logging and construction to reduce soil losses; *severe* if special methods of operation are necessary for preventing excessive soil losses.

Seedling mortality refers to the expected degree of mortality of planted seedlings as influenced by kinds of soil. Considered in the ratings are excessive soil wetness, hazard of flooding, slope and aspect, texture, and structure. Plant competition is also considered in the ratings. Normal rainfall, good planting stock, and proper planting are assumed. A rating of *slight* indicates an expected loss of less than 25 percent of the planted seedlings; *moderate,* a loss of 25 to 50 percent of the seedlings; and *severe,* a loss of more than 50 percent of the seedlings.

Landscaping and windbreak plantings

This section gives information about some of the trees, shrubs, and vines used in landscaping sites for homes, schools, industry, and recreation areas. It also provides information on plants suitable for windbreak use around farmsteads or open fields.

A significant acreage in Green Lake County is subject to soil blowing. Sandy and loamy soils of the Boyer, Gotham, Grellton, Kidder, Lapeer, Oakville, Okee, and Oshtemo series and organic soils of the Adrian, Edwards, Houghton, Palms, and Willette series need the protection of windbreaks as well as careful management to hold down soil loss by blowing.

Height growth of pine windbreaks on some of the sandy soils has been measured; white pine and red pine are generally about 30 feet tall at age 20 years. Laurel willow on muck soils reaches a height of about 30 feet in 10 years, and hybrid poplar reaches a height of 50 feet in 20 years.

Different soils vary widely in suitability for different trees and shrubs and in site conditions. The soils in the county have been placed in four tree and shrub selection groups. These groups are based on the degree and length of time that soil is saturated with water and on the available water capacity. Each of the soils in a specific group has similar suitability for tree, shrub, and vine plantings.

A brief general description of the features of the soils in each tree and shrub group is given in tables 4 and 5. Marsh (Mf), Rock land and Ritchey soils (RkE), and Rock outcrop (Ro) have not been placed in a tree and shrub group. The tree and shrub group that each soil is in can also be found by referring to the "Guide to Mapping Units" at the back of the survey.

Table 4 lists trees suitable for specified uses and gives information on growth form and height at maturity. Table 5 lists shrubs and vines suitable for specified uses and gives information on growth form and esthetic value. It is only a partial list of the plants suited to soils in the county. Many of the plants can be used for both landscaping and providing food and cover for wildlife.

TABLE 4.—*Trees suitable for planting*

[The first letter in parentheses following the plant name indicates the location: A is for sunny sites and B is for partly shady sites. Other letters indicate height: S is less than 30 feet, M is 30 to 60 feet, and L is more than 60 feet. These letters indicate shape: C is columnar, O is oval, P is pyramidal, Q is pendulus, and R is round]

Tree and shrub groups and map symbols	Shade trees	Trees along streets	Trees for lawns	Plants for hedges and screens	Trees for windbreaks
Group 1: Moderately deep and deep, moderately well drained to somewhat excessively drained, fine textured to coarse textured soils that have moderate to very high available water capacity. BsA, BsB, DdB, DdC2, FoA, FoB, GnA, GnB, GnC2, GnD2, GrA, GrB, GrC2, KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE, KwA, KwB, KwC2, KwD2, LaB, LaC2, LaD2, Lb, LrC2, LrD2, LvB, LvC2, LvD2, MdB2, MdC2, MdD2, MnB, MnC2, MsA, MsB, MsC2, OkB, OkC, PnA, PnB, ReB, RtB2, RtC2, RtD2, RtE, ScA, ScB, ScC2, SnB, SnC2, SnD2.	American beech (ABLO), sugar maple (ABLO), red maple (ABMO), red oak (ABLR), white oak (ALR), basswood (ABLO), hackberry (ABMR), white ash (ABLO), sycamore (ALO), bur oak (ALR), Norway maple (AMR), silver maple (ALO), and thornless honeylocust (AMO).	Norway maple (AMR), southern pin oak (AMP), thornless honeylocust (AMO), basswood (ALO), white ash (ALO), sugar maple (ALO), hackberry (AMR), red maple (AMO), Norway maple (BMP), white ash (BLO), basswood (BLO), and sugar maple (BLO).	Flowering crab (ASR), mountain ash (ASO), blue beech (ABSPR), paper birch (AMO), river birch (AMO), Russian-olive (ASR), southern pin oak (AMP), serviceberry (ABSR), horse chestnut (ALR), Norway spruce (ABLP), red pine (ALP), white pine (ABLP), white spruce (ABMP), black cherry (ALO), blue spruce (ABLP), and hawthorn (ASR).	Redcedar (ASP), white-cedar (ABMCP), white pine (ABLP), white spruce (ABMP), Lombardy poplar (ALC), Russian-olive (ASR), and upright yew (ABSP).	White spruce (ABMP), white-cedar (ABMCP), white pine (ABLP), red pine (ALP), and Norway spruce (ALP).
Group 2: Moderately well drained to excessively drained, coarse textured or shallow soils that have moderate to very low available water capacity. BpB, BpC2, BpD, BrB, GaB, GaC, GbC, GbD, OaB, OaC, OaD, OmB, OmC2, RaB, RaC, RhB2, RhC2, RhD2, RsD, RsE, TuB, UrB, UrC2, UrD2.	Bur oak (ALR), hackberry (ABMR), black oak (ALR), silver maple (ALO), green ash (AMO), and thornless honeylocust (AMO).	Green ash (AMO), white ash (ALO), hackberry (ABMR), and thornless honeylocust (AMO).	Flowering crab (ASR), paper birch (AMO), redcedar (ASP), white pine (ABLP), white spruce (ABMP), red pine (ALP), and Russian-olive (ASR).	Redcedar (ASP), Russian-olive (ASR), red pine (ALP), white pine (ABLP), upright yew (ABSP), and white spruce (ABMP).	Red pine (ALP), white pine (ABLP), and redcedar (ASP).
Group 3: Somewhat poorly drained and poorly drained mineral soils and land type. An, Bb, Co, Gf, GhA, GkA, JoA, KbA, MaA, McA, Mh, Os, Pr, Py, ZtA.	Swamp white oak (ABLR), hackberry (ABMR), red maple (ABMO), basswood (ABLO), green ash (ABMO), white ash (ABLO), silver maple (ALO), and cottonwood (ALO).	Green ash (ABMO), basswood (ABLO), and red maple (ABMO).	White spruce (ABMP), paper birch (AMO), mountain ash (ABSO), weeping willow (AMPe), white-cedar (AMP), and river birch (AMO).	White-cedar (ABMC), white spruce (ABMP), Lombardy poplar (ALC), and laurel willow (AMO).	White-cedar (ABMC), white spruce (ABMP), and white pine (ALP).
Group 4: Very poorly drained organic soils. Ad, Ed, Ho, Pa, We.	Silver maple (ALO), red maple (ABMO).	Red maple (AMO), and laurel willow (AMO).	White-cedar (ABMC), white spruce (ABMP), and weeping willow (AMPe).	White-cedar (ABMC), and laurel willow (AMO).	Laurel willow (AMO), poplar selections (ALP), tree lilac (ASO), and white-cedar (ABMC).

TABLE 5.—*Shrubs and vines*

Tree and shrub group and map symbols	Common name	Type of plant
Group 1: Moderately deep and deep, moderately well drained to somewhat excessively drained, fine textured to coarse textured soils that have moderate to very high available water capacity. BsA, BsB, DdB, DdC2, FoA, FoB, GnA, GnB, GnC2, GnD2, GrA, GrB, GrC2, KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE, KwA, KwB, KwC2, KwD2, LaB, LaC2, LaD2, Lb, LrC2, LrD2, LvB, LvC2, LvD2, MdB2, MdC2, MdD2, MnB, MnC2, MsA, MsB, MsC2, OkB, OkC, PnA, PnB, ReB RtB2, RtC2, RtD2, RtE, ScA, ScB, ScC2, SnB, SnC2, SnD2.	Arborvitae	Shrub
	Autumn-olive	Shrub
	Barberry, Japanese	Shrub
	Bittersweet	Vine
	Blackberry, dewberry, blackcap raspberry	Bramble
	Chokeberry, black	Shrub
	Cotoneaster	Shrub
	Crabapple	Shrub
	Currant, alpine	Shrub
	Dogwood, gray	Shrub
	Dogwood, pagoda	Shrub
	Dogwood, redosier	Shrub
	Dogwood, roundleaf	Shrub
	Dogwood, silky	Shrub
	Elder, American	Shrub
	Filbert (hazelnut)	Shrub
	Forsythia	Shrub
	Grape, wild	Vine
	Hawthorn or thornapple	Shrub
	Honeysuckle	Shrub
	Juniper, creeping	Shrub
	Juniper, Pfitzer	Shrub
	Lilac	Shrub
	Maple, Amur	Shrub
	Mockorange	Shrub
	Myrtle or periwinkle	Vine
	Ninebark, common	Shrub
	Peashrub, Siberian	Shrub
	Pine, mugho	Shrub
	Plum, American	Shrub
	Privet, Amur	Shrub
	Privet, Regels border	Shrub
	Redcedar, eastern	Shrub
	Rose, rugosa and horticultural varieties	Shrub
	Russian-olive	Shrub
	Snowberry	Shrub
	Spirea, Anthony Waterer	Shrub
	Spirea, vanhoutte	Shrub
	Sumac, fragrant	Shrub
	Sumac, smooth	Shrub
	Sumac, staghorn	Shrub
	Viburnum, American cranberry-bush	Shrub
	Viburnum, arrowwood	Shrub
	Viburnum, blackhaw	Shrub
	Viburnum, mapleleaf	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, rafinesque	Shrub
	Viburnum, wayfaringtree	Shrub
	Virginiacreeper	Vine
	Wahoo, Eastern	Shrub
	Weigela	Shrub
	Willows, shrubby types including pussy willow.	Shrub
	Winterberry, common	Shrub
	Yew, shrub type	Shrub

suited to the soils

Potential height	Shade-tolerant plants	Plants suitable for—				
		Land-scaping	Hedge, screen, or windbreak	Wildlife food and cover	Roadside planting	Ground cover
Ft						
3–7		X	X	X		
10–15	X	X	X	X		
6	X	X	X	X		
	X	X		X	X	X
1–5				X	X	X
1–3	X	X		X	X	X
4–8		X	X	X		
10–25		X	X	X	X	
6–7	X	X	X			
6–10	X			X	X	
10–15	X			X	X	
3–9	X					
3–9	X			X	X	X
6–10	X		X	X	X	
3–10				X	X	X
5–8	X			X	X	
4–8	X	X				
	X			X	X	X
5–15	X			X	X	
6–12	X	X	X	X		
1–2		X		X	X	X
8–10		X		X		
8–10		X	X		X	
1		X	X			
6–9		X	X			
1	X	X			X	X
6–9	X	X	X		X	
10–15			X	X	X	
6–9		X		X		
10–15	X			X	X	
10	X		X	X		
6–9	X		X	X		
6–9	X		X	X	X	
2–6		X		X	X	
15+		X	X	X		
3–4	X	X		X	X	X
2–3		X				
5–6	X	X	X			
3	X	X		X	X	X
6–10				X	X	
10–15	X			X	X	
7–9	X	X	X	X	X	
10–12	X	X	X	X		
8–10	X		X	X	X	
3–5	X			X	X	
9–12	X		X	X	X	
2–4	X			X	X	
4–9	X	X		X	X	
	X			X	X	X
4–9	X	X		X	X	
4–8		X	X			
2–8		X	X	X	X	
6–9	X			X	X	
3–10	X	X		X		

TABLE 5.—*Shrubs and vines*

Tree and shrub group and map symbols	Common name	Type of plant
Group 2: Moderately well drained to excessively drained, coarse textured or shallow soils with moderate to very low available water capacity. BpB, BpC2, BpD, BrB, GaB GaC, GbC, GbD, OaB, OaC, OaD, OmB, OmC2, RaB, RaC, RhB2, RhC2, RhD2, RsD, RsE, TuB, UrB, UrC2, UrD2.	Arborvitae	Shrub
	Autumn olive	Shrub
	Barberry, Japanese	Shrub
	Bayberry or waxmyrtle	Shrub
	Bittersweet	Vine
	Blackberry, dewberry, blackcap raspberry	Bramble
	Chokeberry, black	Shrub
	Cotoneaster	Shrub
	Crabapple	Shrub
	Currant, alpine	Shrub
	Dogwood, gray	Shrub
	Filbert (hazelnut)	Shrub
	Forsythia	Shrub
	Grape, wild	Vine
	Hawthorn or thornapple	Shrub
	Honeysuckle	Shrub
	Juniper, creeping	Shrub
	Juniper, Pfitzer	Shrub
	Lilac	Shrub
	Maple, Amur	Shrub
	Mockorange	Shrub
	Myrtle or periwinkle	Vine
	Ninebark, common	Shrub
	Peashrub, Siberian	Shrub
	Pine, mugho	Shrub
	Plum, American	Shrub
	Privet, Amur	Shrub
	Privet, Regels border	Shrub
	Redcedar, eastern	Shrub
	Russian-olive	Shrub
	Snowberry	Shrub
	Spirea, Anthony Waterer	Shrub
	Spirea, vanhoutte	Shrub
	Sumac, fragrant	Shrub
	Sumac, smooth	Shrub
	Sumac, staghorn	Shrub
	Viburnum, blackhaw	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, rafinesque	Shrub
	Viburnum, wayfaringtree	Shrub
	Virginiacreeper	Vine
	Willows, shrubby types including pussy willow.	Shrub
Group 3: Somewhat poorly drained and poorly drained mineral soils and land type. An, Bb, Co, Gf, GhA, GkA, JoA, KbA, MaA, McA, Mh, Os, Pr, Py, Z+A.	Arborvitae	Shrub
	Autumn-olive	Shrub
	Bayberry or waxmyrtle	Shrub
	Dogwood, gray	Shrub
	Dogwood, pagoda	Shrub
	Dogwood, redosier	Shrub
	Dogwood, roundleaf	Shrub
	Dogwood, silky	Shrub
	Elder, American	Shrub
	Hawthorn or thornapple	Shrub
	Honeysuckle	Shrub
	Ninebark, common	Shrub
	Plum, American	Shrub
	Russian-olive	Shrub
	Spirea, narrow-leaf	Shrub
	Spirea, vanhoutte	Shrub
	Viburnum, American cranberry-bush	Shrub
	Viburnum, mapleleaf	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, wayfaringtree	Shrub
	Willows, shrubby types including pussy willow.	Shrub
	Winterberry, common	Shrub

suited to the soils—Continued

Potential height	Shade-tolerant plants	Plants suitable for—				
		Land-scaping	Hedge, screen, or windbreak	Wildlife food and cover	Roadside planting	Ground cover
Ft						
3–7		X	X	X		
10–15	X	X	X	X		
6	X	X	X	X		
5–9	X	X		X		X
	X	X		X	X	X
1–5				X	X	X
1–3	X	X		X	X	X
4–8		X	X	X		
10–25		X	X	X	X	
6–7	X	X	X			
6–10	X			X	X	
5–8	X			X	X	
4–8	X	X				
	X			X	X	X
5–15	X			X	X	
6–12	X	X	X	X		
1–2		X		X	X	X
8–10		X		X		
8–10		X	X		X	
1		X	X			
6–9		X	X			
1	X	X			X	X
6–9	X	X	X		X	
10–15			X	X	X	
6–9		X		X		
10–15	X			X	X	
10	X		X	X		
6–9	X		X	X		
6–9	X		X	X	X	
15+		X	X	X		
3–4	X	X		X	X	X
2–3		X				
5–6	X	X	X			
3	X	X		X	X	X
6–10				X	X	
10–15	X			X	X	
8–10	X		X	X	X	
9–12	X		X	X	X	
2–4	X			X	X	
4–9	X	X		X	X	
	X			X	X	X
2–8		X	X	X	X	
3–7		X	X	X		
10–15	X	X	X	X		
5–9	X	X		X		X
6–10	X			X	X	
10–15	X			X	X	
3–9	X					
3–9	X			X	X	X
6–10	X		X	X	X	
3–10				X	X	X
5–15	X			X	X	
6–12	X	X	X	X		
6–9	X	X	X		X	
10–15	X			X	X	
15+		X	X	X		
3–4					X	
5–6	X	X	X			
7–9	X	X	X			
3–5	X			X	X	
9–12	X		X	X	X	
4–9		X		X	X	
2–8	X	X	X	X	X	
6–9				X	X	
	X					

TABLE 5.—*Shrubs and vines*

Tree and shrub group and map symbols	Common name	Type of plant
Group 4: Very poorly drained organic soils. Ad, Ed, Ho, Pa, We.	Arborvitae	Shrub
	Dogwood, redosier	Shrub
	Dogwood, roundleaf	Shrub
	Dogwood, silky	Shrub
	Elder, American	Shrub
	Honeysuckle	Shrub
	Ninebark, common	Shrub
	Viburnum, American cranberry-bush	Shrub
	Viburnum, mapleleaf	Shrub
	Viburnum, nannyberry	Shrub
	Viburnum, wayfaringtree	Shrub
	Willows, shrubby types including pussy willow.	Shrub
	Winterberry, common	Shrub

Wildlife[3]

The soils of Green Lake County differ widely in physical and chemical characteristics. These characteristics affect the kind and amounts of vegetation and wildlife the soils will support. There is a direct relationship between soil fertility and wildlife kinds and abundance. This correlation is applicable to upland and wetland soils, plants and animals, and domestic animals and wildlife.

Food and cover planting on lands used primarily or secondarily for wildlife encourage wildlife. Stripcropping, fertilization, and tree planting in pastures, woodland, or other areas benefit wildlife.

Most of the major soils are suitable for fairly intensive farming. They have a high potential for wildlife but, because of other uses, there is little wildlife habitat.

The soils of Green Lake County are in ten wildlife groups. Soils in group 9 do not occur in Green Lake County. Groups 1 and 3, the somewhat excessively drained, well drained, and moderately well drained sandy and loamy soils, have the most acreage in the county. These groups are capable of producing good habitat for most wildlife. Group 5, the well drained and moderately well drained prairie soils, also has large amounts of acreage.

The most important soil groups for wildlife habitat are groups 6 and 7, the somewhat poorly drained to very poorly drained mineral soils and land types, and group 8, the organic soils. These groups contain the valuable wetlands and cover about 80,000 acres. In 1938, Green Lake County had about 60,000 acres in wetlands. Since 1938, 16,000 acres of wetlands have been converted to other uses and presently about 44,000 acres remain in wetlands. Wetland groups 3, 4, and 5 have increased from about 1,000 acres in 1938 to about 3,600 acres. Private landowners have developed wetlands, and public agencies have purchased and improved wetlands.

In table 6, wildlife groups are rated for seven elements of wildlife habitat. The ratings indicate relative suitability of various elements. A rating of *good* means the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *fair* means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results, however.

A rating of *poor* means the element of wildlife habitat faces severe limitations for the designated use. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

Grain and seed crops include corn, oats, sorghums, wheat, barley, rye, or soybeans.

Grasses and legumes include switchgrass, bromegrass, timothy, fescue, alfalfa, red clover, sweet clover, and vetch.

Wild herbaceous upland plants include native or introduced grasses, legumes, and forbs that provide food and cover for upland wildlife and are mainly established by natural means. Important plants are bluegrass, roundhead lespedeza, beggarstick, aster, and goldenrod.

Woody plants include hardwood trees and shrubs and coniferous trees. Hardwood trees such as oaks, maples, cherry, and nut trees furnish mast, fruit, seeds, dens, cover, and browse for wildlife. Shrubs are low-growing woody plants, including conifers less than 8 feet tall, that furnish fruit, seeds, browse, and cover for wildlife. Examples are viburnums, dogwood, and hazelnut. Coniferous trees that are more than 8 feet tall furnish seeds, fruit, browse, and cover for

[3]By LAVERNE C. STRICKER, biologist, Soil Conservation Service, at Madison.

suited to the soils—Continued

Potential height	Shade-tolerant plants	Plants suitable for—				
		Land-scaping	Hedge, screen, or windbreak	Wildlife food and cover	Roadside planting	Ground cover
Ft						
3–7		X	X	X		
3–9	X					
3–9	X			X	X	X
6–10	X		X	X	X	
3–10				X	X	X
6–12	X	X	X	X		
6–9	X	X	X		X	
7–9	X	X	X	X	X	
3–5	X			X	X	
9–12	X		X	X	X	
4–9	X	X		X	X	
2–8		X	X	X	X	
6–9	X			X	X	

wildlife. Examples are pines, firs, spruce, tamarack, and cedar.

Wetland plants for food and cover include forbs, grasses, sedges, aquatic plants, and woody plants that grow well in wet areas. They furnish fruit, seeds, browse, and cover for wildlife that live in wet areas and on or near open water. Examples are smartweed, canarygrass, sedges, arrowhead, alder, and willow. These plants grow well in type 1, 2, and 6 wetlands as defined in U.S. Department of the Interior Circular 39 (*19*). Type 1 wetlands are seasonally flooded basins and nearly level areas that are covered with water or saturated with water during seasonal wet periods but are generally relatively dry during much of the growing season. Type 2 wetlands include fresh meadows that are generally not covered by water during the growing season but are saturated within a few inches of the soil surface. Type 6 wetlands consist of shrub swamp areas in which the soil is generally saturated during the growing season.

Deep water areas are areas where water is more than 5 feet deep. They are natural or are dug. Common plants are coontail, water lilies, milfoil, and water weed. The deep water areas consist of ponds, lakes, and type 5 wetlands. Type 5 wetlands are open freshwater areas that include shallow ponds and reservoirs or wet areas where water is less than 10 feet deep.

Table 7 lists the important kinds of wildlife in Green Lake County and rates the importance of the various habitat elements.

The suitability of a particular soil for a given species of wildlife can be determined by using tables 6 and 7. For example, critical parts of the habitat for ring-necked pheasants are grass and legumes, wild herbaceous upland plants, and herbaceous wetland plants. Only a combination of soil groups would be well suited for all these habitat elements. An environment containing soils in group 1, loamy, well-drained soils, and group 8, organic soils, would be desirable (fig. 15).

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 8, the soils of Green Lake County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, golf course fairways, and paths and trails.

In table 8, the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, and a surface free of rocks and coarse fragments and are not subject to flooding during periods of heavy use; their surface is firm after rains but not dusty when dry.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops. They have good drainage and are not subject to flooding during periods of heavy use. Their surface is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts that carry heavy foot traffic. Most of the vehicu-

TABLE 6.—*Suitability of the*

Wildlife groups and map symbols	Grain and seed crops	Grasses and legumes
Group 1: Somewhat excessively drained, well drained, and moderately well drained soils that are loamy throughout and not subject to flooding. BpB, BpC2, BpD, DdB, DdC2, GnA, GnB, GnC2, GnD2, KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE, KwA, KwB, KwC2, KwD2, LaB, LaC2, LaD2, Lb, LrC2, LrD2, LvB, LvC2, LvD2, MnB, MnC2, OkB, OkC, OmB, OmC2, ScA, ScB, ScC2, SnB, SnC2, SnD2.	Good where slope is 0 to 6 percent, fair where slope is 6 to 12 percent, and poor where slope is more than 12 percent; water erosion is a hazard.	Good where slope is 0 to 12 percent, fair where slope is 12 to 20 percent, poor where slope is more than 20 percent.
Group 2: Well drained and moderately well drained soils that have a clayey subsoil. BsA, BsB, TuB.	Good	Good
Group 3. Somewhat excessively drained, well drained, and moderately well drained soils that are moderately coarse textured or coarse textured. BrB, GaB, GaC, GbC, GbD, OaB, OaC, OaD, RaB, RaC, UrB, UrC2, UrD2.	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent; water erosion is a hazard.	Fair
Group 4: Soils with shallow or very shallow rooting depth. RhB2, RhC2, RhD2, RsD, RsE.	Fair where slope is 0 to 6 percent; poor where slope is more than 6 percent; water erosion is a hazard.	Good where slope is 0 to 12 percent, fair where slope is 12 to 20 percent, poor where slope is more than 20 percent.
Group 5: Well drained and moderately well drained soils that have a dark-colored surface layer and are loamy throughout. FoA, FoB, GrA, GrB, GrC2, MdB2, MdC2, MdD2, MsA, MsB, MsC2, PnA, PnB, ReB, RtB2, RtC2, RtD2, RtE.	Good where slope is 0 to 12 percent; very poor where slope is more than 12 percent; droughty; soil blowing is a hazard.	Good where slope is 0 to 12 percent; fair where slope is more than 12 percent.
Group 6: Somewhat poorly drained soils. JoA, KbA, MaA, McA ZtA.	Good where soil has been drained; fair where soil is undrained and wet.	Good where soil has been drained; fair where soil is undrained and wet; few species suited.
Group 7: Poorly drained and very poorly drained soils and land types. An, Bb, Co, Gf, GhA, GkA, Mf, Mh, Os, Pr, Py.	Good where soil has been drained; very poor where soil is undrained and wet.	Fair where soil has been drained; poor where soil is undrained and wet.
Group 8: Very poorly drained organic soils. Ad, Ed, Ho, Pa, We.	Fair where soil has been drained; very poor where soil is undrained and wet.	Fair where soil has been drained; very poor where soil is undrained and wet; few plants are suitable.
Group 10: Thin, droughty or stony and rocky land types and very shallow soils. RkE, Ro.	Poor; water erosion is a hazard; shallow to rock; insufficient soil moisture.	Fair where slope is 0 to 12 percent; poor where slope is more than 12 percent; some plants are not suitable; insufficient soil moisture.

soils for wildlife habitat

Wild herbaceous upland plants	Woody plants		Wetland plants for food and cover	Shallow and deep water developments
	Hardwood trees and shrubs	Coniferous trees		
Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; permeability is moderate or moderately rapid.
Good	Good	Good	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Poor: permeability is moderately slow or rapid; slowly permeable clay.
Good	Good	Good	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Very poor: permeability is moderately rapid or rapid.
Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Good where slope is 0 to 20 percent, fair where slope is more than 20 percent.	Poor where slope is 0 to 2 percent, very poor where slope is more than 2 percent; few plants are suitable.	Very poor: permeability is very rapid; creviced bedrock.
Good	Fair	Fair	Very poor	Very poor.
Fair; wet soil; some species not suited.	Fair; wet soil; some hardwoods are not suitable.	Fair; wet soil; some conifers are not suitable.	Good	Good where slope is 0 to 2 percent; fair where slope is more than 2 percent; wet soil; permeability is moderate or rapid in some soils.
Very poor; very wet soil; few plants are suitable.	Poor; very wet soil; few hardwoods are suitable.	Poor; very wet soil; few plants are suitable.	Good	Good.
Very poor; wet soil; few plants are suitable.	Poor; wet soil; some plants are suitable.	Fair; wet soil; some plants are not suitable.	Good	Good where slope is 0 to 2 percent; fair where slope is more than 2 percent; wet soil.
Fair where slope is 0 to 12 percent; poor where slope is more than 20 percent; some plants are not suitable; insufficient soil moisture.	Poor; few plants are suitable; insufficient soil moisture.	Poor; few plants are suitable; insufficient soil moisture.	Very poor; insufficient soil moisture.	Very poor: shallow to creviced dolomite or igneous rock.

TABLE 7.—*Elements of habitat needed by wildlife*

[The numeral 1 means that the element of habitat is of little value for the survival of that kind of wildlife; 2 means that it is of some value; 3 means that it is important; 4 means that it is very important; and 5 means that it is a critical element of survival. Dashes mean that the element of habitat is not suited to that kind of wildlife. Some carnivorous animals are not strictly dependent on these listed elements]

Kinds of wildlife	Grain and seed crops		Grasses and legumes		Wild herbaceous upland plants	Woody plants			Wetland plants for food and cover	Shallow water areas	Deep water areas
						Hardwoods		Coniferous trees			
	Harvested	Not harvested	Harvested	Not harvested		Shrubs	Trees				
Migratory waterfowl:											
Ducks	3	3	1	3	3	---	1	---	5	5	4
Geese	4	5	4	1	---	---	---	---	2	3	3
Upland birds:											
Hungarian partridge	4	4	3	4	4	1	---	---	1	---	---
Pheasant	4	4	---	5	5	4	---	1	5	3	---
Quail	4	4	2	4	4	5	2	1	4	3	---
Woodcock	---	---	1	3	3	4	4	2	3	---	---
Mammals:											
Rabbits, cottontail	3	4	3	5	5	5	3	1	2	3	---
Raccoon	3	4	---	1	1	2	4	---	1	5	4
Squirrels, fox and gray	3	4	---	1	1	2	5	1	---	---	---
Deer	3	4	3	3	4	4	4	4	3	3	2
Beaver	---	---	---	---	---	4	5	---	4	4	5
Red fox	2	3	2	3	3	3	2	1	3	3	1
Mink	---	---	---	---	---	2	1	1	3	5	5
Muskrat	1	1	---	---	---	1	---	---	4	5	5

lar traffic is confined to access roads. The best soils are firm when wet but not dusty when dry, are not subject to flooding during the season of use, and do not have slopes or stoniness that greatly increases cost of leveling sites or of building access roads.

Golf course fairways are areas between greens or holes on the course. Ratings are for the undisturbed soil, which needs to withstand intensive foot and vehicular traffic. The best soils have good drainage, a surface free of rocks and coarse fragments, a high available water capacity, and moderate permeability. They are not subject to flooding during periods of heavy use. The soils should be relatively dry during the season of use and be capable of supporting a thick turf without special management.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are not flooded more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering[4]

This section is useful to planning commissions, town and city managers, land developers, engineers, contractors, farmers, and others who need information about soils used as structural material or as foundation on which structures are built.

Among the properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to help predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

[4] HARRY C. BROWN, civil engineer, Soil Conservation Service, helped prepare this section.

Figure 15.—Corn growing in an area of Oakville soils is in the foreground. Houghton soils are in the wetland area. Alfalfa and pine in the background are growing in an area of Boyer and Rodman soils. These different soils provide good habitat for pheasant, deer, and other wildlife.

7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables. Table 9 shows estimates of several soil properties significant to engineering. Table 10 gives interpretations for various engineering uses. Table 11 gives soil features affecting water management. Table 12 shows results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition to those given in tables 9, 10, and 11, and it also can be used to make useful maps.

This information, however, does not eliminate need for investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 5 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil can include small areas of other kinds of soil that have strongly contrasting properties and different suitability or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists. The Glossary defines many of these terms.

Classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by the SCS engineers, the Department of Defense, and others, and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO).

In the Unified system (*2*) soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system (*1*) is used to classify soils according to those properties that affect use in high-

TABLE 8.—*Recreational limitations of the soils*

Recreation groups and map symbols	Camp areas	Playgrounds	Picnic areas	Golf course fairways	Paths and trails
Group 1: Well drained and moderately well drained soils that have a sandy loam, fine sandy loam, loam, or silt loam surface layer and moderate or moderately rapid permeability. DdB, DdC2, FoA, FoB, GnA, GnB, GnC2, GnD2, GrA, GrB, GrC2, KdA, KdB, KdC2 KdD2, KeA, KeB, KeC2, KeD2, KeE, LrC2, LrD2, LvB, LvC2, LvD2, MdB2 MdC2 MdD2, MsA, MsB, MsC2, PnA, PnB RtB2, RtC2, RtD2, RtE, ScA, ScB, ScC2, SnB, SnC2, SnD2.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, and severe where slope is more than 12 percent: sloping soil is erodible; silt loam soil compacts when wet.	Slight where slope is 0 to 2 percent, moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: sloping soils are erodible; silt loam soils compact when wet; extensive leveling will expose coarse fragments.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: sloping soils are erodible; silt loam soils compact when wet.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: sloping soils are erodible; silt loam soils compact when wet.	Slight where slope is 0 to 12 percent, moderate where slope is 12 to 20 percent, severe where slope is more than 20 percent: sloping soils are erodible; silt loam soils are slippery when wet.
Group 2: Excessively drained, somewhat excessively drained, well drained and moderately well drained soils that have a gravelly sandy loam, loamy fine sand or fine sand surface layer and moderate to very rapid permeability. BpB, BpC2, BpD BrB, GaB, GaC, LaB, LaC2, LaD2, Lb, MnB, MnC2, OaB, OaC, OaD, OkB, OkC, OmB, OmC2, RaB, RaC, RsD, RsE.	Moderate where slope is 1 to 12 percent, severe where slope is more than 12 percent: sandy surface layer.	Moderate where slope is 1 to 6 percent, severe where slope is more than 6 percent: sandy surface layer; subject to blowing.	Moderate where slope is 1 to 12 percent, severe where slope is more than 12 percent: sandy surface layer; subject to blowing.	Moderate where slope is 1 to 12 percent, severe where slope is more than 12 percent: sandy surface layer; subject to blowing.	Moderate where slope is 1 to 20 percent, severe where slope is more than 20 percent: sandy surface layer; subject to blowing.
Group 3: Moderately well drained to somewhat excessively drained soils that have a silt loam or loamy fine sand surface layer and moderately slow or slow permeability. BsA, BsB TuB.	Moderate: moderately slow or slow permeability.	Moderate: moderately slow or slow permeability.	Slight where surface layer is silt loam, moderate where surface layer is loamy fine sand.	Slight where surface layer is silt loam, moderate where surface layer is loamy fine sand.	Slight where surface layer is silt loam, moderate where surface layer is loamy fine sand.
Group 4: Somewhat excessively drained and well drained soils underlain by bedrock at a depth of 20 to 40 inches. GbC, GbD, KwA, KwB, KwC2, KwD2, ReB, UrB, UrC2, UrD2.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: sloping soils are erodible; silt loam soils compact when wet; sandy soils subject to blowing.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: sloping soils are erodible; silt loam soils compact when wet; sandy soils subject to blowing; extensive leveling may expose bedrock.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: sloping soils are erodible; silt loam soils compact when wet; sandy soils subject to blowing.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: sloping soils are erodible; silt loam soils compact when wet; sandy soils subject to blowing.	Slight where slope is 0 to 12 percent, moderate where slope is 12 to 20 percent, severe where slope is more than 20 percent: sloping soils are erodible; silt loam soils are slippery when wet; sandy soils subject to blowing.
Group 5: Excessively drained, somewhat excessively drained, and well drained soils that have bedrock at a depth of less than 20 inches. RhB2, RhC2, RhD2, RkE, Ro.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: shallow to bedrock; coarse fragments on surface.	Severe: fragments of bedrock on surface; extensive leveling will expose bedrock.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: exposed bedrock and coarse fragments on surface.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: exposed bedrock and coarse fragments on surface.	Slight where slope is 2 to 12 percent, moderate where slope is 12 to 20 percent, severe where slope is more than 20 percent: exposed bedrock and coarse fragments on surface.

TABLE 8.—*Recreational Limitations of the soils*—Continued

Recreation groups and map symbols	Camp areas	Playgrounds	Picnic areas	Golf course fairways	Paths and trails
Group 6: Somewhat poorly drained soils. JoA, KbA, MaA, McA, ZtA.	Severe: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.	Moderate: seasonal saturation with water; subject to occasional flooding.
Group 7: Poorly drained and very poorly drained soils. An, Bb, Co, Gf, GhA, GkA, Mh, Os, Pr, Py.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.
Group 8: Very poorly drained organic soils and marsh. Ad, Ed, Ho, Mf, Pa, We.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.	Very severe: high water table; organic soil; subject to flooding; subject to subsidence and blowing if drained.

way construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 12; the estimated classification, without group index numbers, is given in table 9 for all soils mapped in the survey area.

Soil properties

Several estimated soil properties significant in engineering are given in table 9. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 9.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 9 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from semisolid to plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic; and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 9, but in table 12 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 9 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume of soil material to be expected with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet.

TABLE 9.—*Estimated soil properties*

[The symbol > mean greater than;

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Adrian: Ad	[2] 0–1	0–36	Muck	Pt		
		36–60	Fine sand	SP	A–3	
Alluvial land, wet: An. Too variable to be estimated.						
Barry: Bb	[2] 0–1	0–13	Loam	CL or CL–ML	A–4	
		13–24	Clay loam	CL	A–6	0–2
		24–31	Sandy loam	SM or SC–SM	A–2 or A–4	0–2
		31–60	Gravelly loamy sand	SM	A–2	2–7
Boyer: BpB, BpC2, BpD	>5	0–14	Loamy fine sand	SM	A–2	
		14–27	Sandy loam	SM or SC–SM	A–2 or A–4	0–2
		27–60	Sand and gravel	SP	A–1	0–5
Brems: BrB	2–3	0–9	Loamy fine sand	SM	A–2	
		9–38	Fine sand	SP	A–3	
		38–60	Sand	SP	A–3	
Briggsville: BsA, BsB	3–>5	0–13	Silt loam	ML or CL	A–4 or A–6	
		13–34	Silty clay	CH	A–7	
		34–60	Silty clay loam, silty clay and clay.	CH	A–7	
Colwood: Co	[2] 0–1	0–10	Silt loam	ML or CL	A–4 or A–6	
		10–22	Heavy loam	CL	A–6	
		22–60	Silt loam, silt, fine sand and very fine sand.	CL or CL–ML	A–4	
Dodge: DdB, DdC2	>5	0–8	Silt loam	ML or CL–ML	A–4	
		8–27	Silty clay loam	CL	A–6	
		27–33	Clay loam	CL	A–6	
		33–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Edwards: Ed	[2] 0–1	0–30	Muck	Pt		
		30–60	Marl			
Friesland: FoA, FoB	3–>5	0–38	Loam	ML or CL–ML	A–4	
		38–74	Silt loam	CL or CL–ML	A–4 or A–6	
Gotham:						
GaB, GaC	>5	0–29	Loamy fine sand	SM	A–2	
		29–60	Sand	SP	A–3	
GbC, GbD	>5	0–37	Loamy fine sand	SM	A–2	
		37–60	Sandstone.			
Granby: Gf	[2] 0–1	0–11	Loamy fine sand	SM	A–2	
		11–35	Fine sand	SP	A–3	
		35–60	Fine sand	SP	A–3	
Granby, loamy subsoil variant: GhA.	[2] 0–1	0–11	Loamy fine sand	SM	A–2	
		11–30	Fine sand	SP	A–3	
		30–60	Sandy loam	SM or SC–SM	A–2 or A–4	
Granby, clayey subsoil variant: GkA.	[2] 0–1	0–12	Loamy fine sand	SM	A–2	
		12–33	Fine sand	SP	A–3	
		33–60	Silty clay	CH	A–7	
Grellton: GnA, GnB, GnC2, GnD2	3–>5	0–6	Fine sandy loam	SM or SC–SM	A–2 or A–4	
		6–31	Loam	CL or CL–ML	A–4	
		31–47	Silt loam	CL or CL–ML	A–4 or A–6	
		47–56	Sandy clay loam	SC or SC–SM	A–4	0–2
		56–60	Gravelly sandy loam	SM	A–2 or A–4	2–7

See footnotes at end of table.

significant to engineering

the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[1]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
						6.0–20.0	0.35–0.45	6.1–7.3		High	Moderate.
100	90–100	65–80	1–5		[2] NP	6.0–20.0	0.03–0.08	6.6–7.3	Low	High	Low.
95–100	90–100	85–95	60–70	20–29	5–10	0.6–2.0	0.20–0.22	6.1–7.3	Low	High	Low.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	6.1–7.3	Moderate	High	Low.
90–100	85–95	60–70	30–40	10–20	2–6	2.0–6.0	0.12–0.14	7.4–7.8	Low	High	Low.
80–90	75–85	50–75	15–30		NP	2.0–6.0	0.06–0.08	7.9–8.4	Low	High	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	5.6–6.5	Low	Low	Moderate.
90–100	85–95	60–70	20–40	10–20	2–6	2.0–6.0	0.12–0.14	6.1–6.5	Low	Low	Moderate.
60–70	60–70	40–50	1–5		NP	>20.0	[3]	7.9–8.4	Low	Low	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	5.6–6.0	Low	Low	Moderate.
100	90–100	65–80	1–5		NP	>20.0	0.06–0.08	5.6–6.5	Low	Low	Moderate.
100	90–100	65–80	1–5		NP	>20.0	0.05–0.07	6.1–6.5	Low	Low	Moderate.
	100	90–100	70–90	30–40	6–15	0.6–2.0	0.22–0.24	5.6–7.3	Moderate	Low	Moderate.
	100	95–100	90–100	55–65	35–40	0.2–0.6	0.11–0.13	5.1–6.0	High	High	Moderate.
	100	95–100	90–95	50–60	30–35	0.2–0.6	0.16–0.18	7.9–8.4	High	High	Low.
	100	90–100	70–90	30–40	6–15	0.6–2.0	0.22–0.24	7.4–7.8	Moderate	High	Low.
100	95–100	85–100	60–75	30–40	15–25	0.6–2.0	0.17–0.19	7.4–7.8	Moderate	High	Low.
100	95–100	90–100	70–85	20–30	5–10	0.6–2.0	0.20–0.22	7.4–7.8	Moderate	High	Low.
	100	90–100	70–90	20–30	1–5	0.6–2.0	0.22–0.24	6.6–7.3	Low	Low	Low.
	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate	Moderate.
95–100	95–100	90–100	55–80	25–35	11–20	0.6–2.0	0.15–0.19	5.6–6.0	Moderate	Moderate	Moderate.
75–90	70–80	60–70	30–40		NP	0.6–2.0	0.08–0.10	7.9–8.4	Low	Low	Low.
						6.0–20.0	0.25–0.35	6.6–8.4		High	Low.
90–100	90–100	90–100	90–100			0.06–0.2	0.16–0.20	7.9–8.4	Moderate	High	Low.
95–100	90–100	85–100	65–75	10–19	2–5	0.6–2.0	0.17–0.19	5.6–6.0	Low	Low	Moderate.
	100	90–100	70–95	25–40	5–20	0.6–2.0	0.20–0.22	5.6–8.4	Moderate	Low	Moderate.
100	90–100	65–85	15–25		NP	6.0–20.0	0.09–0.11	6.6–7.3	Low	Low	Low.
100	90–100	50–70	1–5		NP	6.0–20.0	0.05–0.07	6.6–7.3	Low	Low	Low.
100	90–100	65–85	15–25		NP	6.0–20.0	0.09–0.11	6.6–7.3	Low	Low	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.1–7.3	Low	High	Moderate.
100	90–100	65–80	1–5		NP	6.0–20.0	0.06–0.08	6.1–6.5	Low	High	Moderate.
100	90–100	65–80	1–5		NP	6.0–20.0	0.05–0.07	6.6–7.3	Low	High	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.1–7.3	Low	High	Moderate.
100	90–100	65–80	1–5		NP	6.0–20.0	0.06–0.08	6.6–7.3	Low	High	Low.
95–100	90–100	60–70	30–40	10–20	2–6	0.6–2.0	0.11–0.13	6.6–7.3	Low	High	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	7.4–7.8	Low	High	Low.
100	90–100	65–80	1–5		NP	6.0–20.0	0.06–0.08	7.4–7.8	Low	High	Low.
	100	95–100	90–100	50–59	30–32	0.06–0.2	0.10–0.12	6.6–7.3	High	High	Low.
90–100	85–95	60–70	30–40	10–20	2–6	2.0–6.0	0.16–0.18	6.1–6.5	Low	Low	Moderate.
95–100	85–95	85–95	60–75	20–29	5–10	0.6–2.0	0.17–0.19	5.6–6.5	Moderate	Low	Moderate.
100	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	6.1–6.5	Moderate	Low	Moderate.
95–100	90–100	80–90	35–50	20–29	5–10	0.6–2.0	0.15–0.17	6.1–7.3	Moderate	Moderate	Moderate.
80–90	75–85	60–70	30–40		NP	0.6–2.0	0.08–0.10	7.9–8.4	Low	Low	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Griswold: GrA, GrB, GrC2	>5	0–12	Silt loam	ML or CL–ML	A–4	
		12–24	Clay loam	CL	A–6	0–2
		24–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Houghton: Ho	[2] 0–1	0–60	Muck	Pt		
Joy: JoA	[2] 1–3	0–11	Silt loam	ML or CL–ML	A–4	
		11–57	Silt loam	CL or CL–ML	A–4 or A–6	
		57–65	Silt loam	CL or CL–ML	A–4 or A–6	
Kibbie: KbA	[2] 1–3	0–21	Loam	CL or CL–ML	A–4	
		21–33	Clay loam	CL	A–6	
		33–60	Silt loam, silt and very fine sand.	CL or CL–ML	A–4	
Kidder: KdA, KdB, KdC2, KdD2 KeA, KeB KeC2, KeD2, KeE.	>5	0–11	Fine sandy loam	SM or SC–SM	A–2 or A–4	
		11–34	Sandy clay loam	SC, SC–SM, CL, or CL–ML	A–4 or A–6	0–2
		34–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Knowles: KwA, KwB, KwC2, KwD2	>5	0–22	Silt loam	ML or CL–ML	A–4	
		22–35	Silty clay loam	CL	A–6	
		35–60	Dolomite.			
Lapeer: LaB, LaC2, LaD2, Lb	>5	0–6	Loamy fine sand	SM	A–2	
		6–28	Silt loam	SC, SM or SC–SM	A–2 or A–4	0–2
		28–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
LeRoy: LrC2, LrD2	>5	0–6	Silt loam	ML or CL–ML	A–4	
		6–10	Silty clay loam	CL	A–6	
		10–18	Clay loam	CL	A–6	0–5
		18–60	Very gravelly sandy loam.	SM, SP–SM, GM or GP–GM	A–2 or A–4	3–10
Lomira: LvB, LvC2, LvD2	>5	0–23	Silt loam	ML or CL–ML	A–4	
		23–29	Silty clay loam	CL	A–6	
		29–35	Clay loam	CL	A–7	0–2
		35–60	Very gravelly sandy loam.	SM, SP–SM, GM or GP–SM	A–2 or A–4	3–10
Manawa: MeA	[2] 1–3	0–9	Silt loam	ML or CL	A–7	
		9–26	Clay	CH	A–7	
		26–60	Silty clay loam	CL	A–7	
Marcellon: McA	[2] 1–3	0–13	Loam	CL or CL–ML	A–4	0–1
		13–35	Clay loam	CL	A–6	0–1
		35–60	Gravelly sandy loam	SM	A–2 or A–4	3–5
Markesan: MdB2, MdC2, MdD2	>5	0–16	Silt loam	ML or CL–ML	A–4	
		16–60	Very gravelly sandy loam.	SM or SP–SM	A–2 or A–4	3–10
Marsh: Mf. Too variable to be rated.	[2] 0–1					
Marshan: Mh	[2] 0–1	0–28	Silt loam	ML or CL	A–4 or A–6	
		28–33	Loam	CL or CL–ML	A–4 or A–6	
		33–60	Sand	SP	A–3	

See footnotes at *end of table.*

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[1]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
	100	90–100	70–90	10–19	2–5	0.6–2.0	0.22–0.24	6.6–7.8	Low	Low	Low.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	5.6–6.0	Moderate	Moderate	Moderate.
80–90	75–85	60–70	30–40		NP	0.6–2.0	0.08–0.10	6.1–8.4	Low	Low	Low.
						6.0–20.0	0.25–0.35	6.1–7.3		High	Moderate.
	100	90–100	70–90	20–29	2–5	0.6–2.0	0.22–0.24	6.6–7.3	Low	High	Low.
	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	5.1–5.5	Moderate	High	Moderate.
	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	6.6–7.3	Moderate	High	Low.
100	95–100	85–95	60–75	20–29	5–10	0.6–2.0	0.20–0.22	5.6–7.8	Low	High	Moderate.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	6.6–7.3	Moderate	High	Low.
100	95–100	90–100	70–85	20–30	5–10	0.6–2.0	0.20–0.22	7.9–8.4	Moderate	High	Low.
90–100	85–95	60–70	30–40	10–20	2–6	2.0–6.0	0.16–0.18	5.6–6.5	Low	Low	Moderate.
95–100	90–100	80–95	36–55	20–29	5–15	0.6–2.0	0.16–0.18	6.6–7.8	Low	Moderate	Low.
80–90	75–90	60–80	30–40		NP	0.6–2.0	0.08–0.10	7.9–8.4	Low	Low	Low.
	100	90–100	70–90	20–29	2–5	0.6–2.0	0.20–0.22	5.1–7.3	Low	Low	Moderate.
	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	5.1–7.8	Moderate	Moderate	Moderate.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.6–7.3	Low	Low	Low.
90–100	85–95	60–80	30–40	<25	NP–10	0.6–2.0	0.12–0.14	6.1–6.5	Low	Low	Moderate.
75–90	75–85	60–70	20–40		NP	0.6–2.0	0.08–0.10	7.4–8.4	Low	Low	Low.
	100	90–100	70–90	20–30	2–5	0.6–2.0	0.22–0.24	6.6–7.3	Low	Low	Low.
	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	6.6–7.3	Moderate	Moderate	Low.
95–100	90–100	85–95	70–80	25–35	11–20	0.6–2.0	0.15–0.19	6.6–7.3	Moderate	Moderate	Low.
55–75	50–70	45–60	10–40		NP	0.6–2.0	0.05–0.07	7.9–8.4	Low	Low	Low.
	100	90–100	70–90	20–30	2–5	0.6–2.0	0.20–0.22	6.1–7.3	Low	Low	Low.
	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	5.6–6.0	Moderate	Moderate	Moderate.
75–85	75–85	70–100	55–80	41–50	22–30	0.6–2.0	0.15–0.19	6.1–6.5	Moderate	Moderate	Low.
55–75	50–70	45–60	10–40		NP	0.6–2.0	0.05–0.07	7.9–8.4	Low	Low	Low.
	100	90–100	70–90	40–50	16–20	0.6–2.0	0.22–0.24	7.4–7.8	Moderate	High	Low.
	100	95–100	85–95	50–59	30–32	0.06–0.2	0.9–0.11	7.4–7.8	High	High	Low.
	100	95–100	85–95	40–50	21–30	0.06–0.2	0.18–0.20	7.9–8.4	Moderate	High	Low.
95–100	90–100	85–95	60–75	20–29	5–10	0.6–2.0	0.20–0.22	6.6–7.8	Low	High	Low.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	7.4–8.4	Moderate	High	Low.
80–90	75–85	60–70	30–40		NP	2.0–6.0	0.08–0.10	7.9–8.4	Low	High	Low.
95–100	90–100	90–100	70–90	20–30	2–5	0.6–2.0	0.22–0.24	6.1–7.3	Low	Low	Low.
55–75	50–70	45–60	10–40		NP	0.6–2.0	0.02–0.04	7.9–8.4	Low	Low	Low.
	100	90–100	70–90	30–40	6–15	0.6–2.0	0.22–0.24	6.1–7.3	Moderate	High	Low.
100	90–100	85–95	60–75	20–29	5–12	0.6–2.0	0.17–0.19	7.4–7.8	Moderate	High	Low.
100	90–100	50–70	1–5		NP	6.0–20.0	0.05–0.07	7.4–8.4	Low	High	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Mecan: MnB, MnC2	>5	0–18	Loamy fine sand	SM	A–2	
		18–46	Sandy loam	SM, SC or SC–SM	A–2 or A–4	0–2
		46–60	Gravelly loamy sand	SM	A–2	2–7
Mendota: MsA, MsB, MsC2	>5	0–13	Silt loam	ML or CL–ML	A–4	
		13–30	Heavy silt loam	CL or CL–ML	A–4 or A–6	
		30–33	Gravelly loam	CL, ML or CL–ML	A–4	0–5
		33–60	Very gravelly sandy loam.	SM or SP–SM	A–2 or A–4	3–10
Oakville: OaB, OaC, OaD	>5	0–53	Fine sand	SM	A–2	
		53–60	Sand	SM	A–2	
Okee: OkB, OkC	>5	0–25	Loamy fine sand	SM or SP–SM	A–2	
		25–45	Sandy loam	SC, SM or SC–SM	A–2 or A–4	0–2
		45–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Oshtemo: OmB, OmC2	>5	0–14	Loamy fine sand	SM	A–2	
		14–30	Heavy sandy loam	SC or SC–SM	A–2 or A–4	
		30–62	Loamy sand	SM or SP–SM	A–2	
		62–80	Sand	SP	A–3	
Ossian: Os	[a] 0–1	0–18	Silt loam	CH, MH, ML or CL	A–4, A–6 or A–7	
		18–60	Silt loam	CL	A–6	
Palms: Pa	[a] 0–1	0–26	Muck	Pt		
		26–41	Clay loam	CL	A–6	
		41–48	Sandy loam	SM or SC–SM	A–2 or A–4	
		48–60	Silty clay loam	CL	A–6	
Plano: PnA, PnB	3–>5	0–11	Silt loam	ML	A–4	
		11–41	Light silty clay loam	CL	A–6	
		41–54	Silt loam	CL or CL–ML	A–4 or A–6	
		54–58	Sandy loam	SM or SC–SM	A–2 or A–4	0–2
		58–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Poy: Pr	[a] 0–1	0–6	Silty clay loam	CL	A–7	
		6–36	Clay and silty clay	CH or MH	A–7	
		36–60	Fine sand	SP	A–3	
Poygan: Py	[a] 0–1	0–8	Silty clay loam	CL	A–7	
		8–32	Clay	CH	A–7	
		32–60	Silty clay	CL	A–7	
*Richford: RaB, RaC	>5	0–29	Loamy sand	SM or SP–SM	A–2	
		29–37	Heavy sandy loam	SC or SC–SM	A–2 or A–4	0–2
		37–44	Loamy sand	SM or SP–SM	A–2	
		44–60	Fine sand	SP	A–3	
Ripon: ReB	>5	0–23	Silt loam	ML	A–4	
		23–34	Silty clay loam	CL	A–6	
		34–60	Dolomite.			
Ritchey: RhB2, RhC2, RhD2	>5	0–8	Silt loam	ML or CL	A–4 or A–6	
		8–19	Gravelly clay loam	CL	A–7	0–5
		19–60	Dolomite.			
Rock land and Ritchey: RkE. Rock land is too variable to be rated. For Ritchey part of RkE, see Ritchey series.	>5					

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[1]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.6–7.3	Low	Low	Low.
90–100	85–100	60–95	30–45	15–25	2–10	0.6–2.0	0.12–0.14	6.1–7.3	Low	Low	Moderate.
80–90	75–85	50–80	15–30		NP	0.6–6.0	0.06–0.08	7.9–8.4	Low	Low	Low.
	100	90–100	70–90	20–30	2–5	0.6–2.0	0.22–0.24	5.6–6.5	Low	Low	Moderate.
	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	6.1–6.5	Moderate	Moderate	Low.
90–100	85–95	85–95	60–75	10–19	2–10	0.6–2.0	0.14–0.16	7.4–7.8	Low	Low	Low.
55–75	50–70	45–60	10–40		NP	0.6–2.0	0.02–0.04	7.9–8.4	Low	Low	Low.
100	90–100	65–80	20–35		NP	>20.0	0.06–0.08	6.1–7.3	Low	Low	Moderate.
100	90–100	65–80	15–25		NP	>20.0	0.05–0.07	5.6–6.0	Low	Low	Moderate.
90–100	90–100	65–85	10–25		NP	2.0–6.0	0.09–0.11	5.6–6.0	Low	Low	Moderate.
90–100	85–100	60–95	25–40	<25	NP–10	0.6–2.0	0.12–0.14	5.6–6.5	Low	Low	Moderate.
80–95	75–90	60–90	30–40		NP	0.6–2.0	0.08–0.10	7.9–8.4	Low	Low	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.6–7.3	Low	Low	Low.
90–100	85–95	60–70	30–40	20–29	6–10	2.0–6.0	0.12–0.14	6.6–7.3	Low	Low	Low.
95–100	90–100	50–75	10–20		NP	6.0–20.0	0.08–0.10	5.6–6.5	Low	Low	Moderate.
90–100	85–95	50–70	1–5		NP	>20.0	[4]	6.1–6.5	Low	Low	Moderate.
	100	90–100	75–100	30–55	6–30	0.6–2.0	0.22–0.24	6.6–7.3	Moderate	High	Low.
	100	90–100	75–100	30–39	13–22	0.6–2.0	0.20–0.22	6.6–8.4	Moderate	High	Low.
						6.0–20.0	0.25–0.35	6.6–7.8		High	Low.
	100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.19	7.4–7.8	Moderate	High	Low.
95–100	90–100	60–70	30–40	10–20	2–6	2.0–6.0	0.12–0.14	7.4–7.8	Low	High	Low.
	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	7.4–7.8	Moderate	High	Low.
	100	90–100	70–95	20–30	2–5	0.6–2.0	0.22–0.24	6.1–7.3	Low	Low	Low.
	100	95–100	85–100	25–40	11–20	0.6–2.0	0.18–0.20	5.6–6.5	Moderate	Moderate	Moderate.
	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	5.6–6.0	Moderate	Low	Moderate.
90–100	85–95	60–70	30–40	10–20	2–6	0.6–2.0	0.12–0.14	6.6–7.3	Low	Low	Low.
80–90	75–85	60–70	30–40		NP	0.6–2.0	0.08–0.10	7.9–8.4	Low	Low	Low.
	100	95–100	85–95	40–50	21–30	0.6–2.0	0.21–0.23	7.9–8.4	Moderate	High	Low.
	100	90–100	75–95	60–75	33–47	0.06–0.2	0.09–0.11	7.9–8.4	High	High	Low.
100	90–100	65–85	1–5		NP	6.0–20.0	0.05–0.07	7.9–8.4	Low	High	Low.
	100	95–100	85–100	40–50	21–30	0.6–2.0	0.21–0.23	7.4–7.8	Moderate	High	Low.
	100	90–100	75–95	50–59	30–32	0.06–0.2	0.09–0.11	7.4–7.8	High	High	Low.
	100	95–100	90–95	40–49	23–29	0.06–0.2	0.10–0.12	7.9–8.4	Moderate	High	Low.
100	90–100	50–75	10–20		NP	2.0–6.0	0.09–0.11	6.1–6.5	Low	Low	Moderate.
90–100	85–95	60–70	30–40	20–29	6–10	2.0–6.0	0.12–0.14	5.6–6.0	Low	Low	Moderate.
95–100	90–100	50–75	10–20		NP	6.0–20.0	0.09–0.11	5.6–6.0	Low	Low	Moderate.
100	90–100	65–80	1–5		NP	6.0–20.0	0.05–0.07	6.6–7.3	Low	Low	Low.
	100	90–100	70–90	20–30	1–5	0.6–2.0	0.22–0.24	5.6–7.8	Low	Low	Moderate.
	100	95–100	85–95	25–35	11–20	0.6–2.0	0.18–0.20	5.6–8.4	Moderate	Moderate	Moderate.
	100	90–100	70–90	30–40	6–15	0.6–2.0	0.22–0.24	6.6–7.3	Moderate	Low	Low.
80–90	75–85	65–75	60–70	41–50	22–30	0.6–2.0	0.14–0.16	6.6–7.8	Moderate	Moderate	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture	Classification		Coarse fragments greater than 3 inches
				Unified	AASHTO	
	Ft	*In*				*Pct*
Rock outcrop: Ro. Too variable to be rated.	>5					
Rodman: RsD, RsE	>5	0–11	Gravelly sandy loam	SM	A–2 or A–4	0–5
		11–60	Sand and gravel	GP or GP–GM	A–1	5–10
Rotamer: RtB2, RtC2, RtD2, RtE	>5	0–7	Sandy loam	SM or SC–SM	A–2 or A–4	0–1
		7–17	Light clay loam	CL	A–6	0–2
		17–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
St. Charles: ScA, ScB, ScC2	3–>5	0–9	Silt loam	ML or CL–ML	A–4	
		9–48	Heavy silt loam	CL or CL–ML	A–4 or A–6	
		48–54	Heavy sandy loam	SC or SC–SM	A–2 or A–4	
		54–60	Gravelly sandy loam	SM	A–2 or A–4	2–7
Sisson: SnB SnC2, SnD2	>5	0–12	Loam	ML or CL–ML	A–4	
		12–37	Clay loam	SC or CL	A–6	
		37–60	Silt loam, silt and very fine sand.	ML or CL–ML	A–4	
Tustin: TuB	3–>5	0–8	Loamy fine sand	SM	A–2	
		8–34	Fine sand	SP	A–3	
		34–48	Clay	CH	A–7	
		48–60	Silty clay	CL	A–7	
Urne: UrB, UrC2, UrD2	>5	0–7	Loamy fine sand	SM	A–2	
		7–37	Fine sandy loam	SM or SC–SM	A–2 or A–4	
		37–60	Sandstone.			
Willette: We	[2] 0–1	0–30	Muck	Pt		
		30–60	Clay	CH	A–7	
Zittau: ZtA	[2] 1–3	0–8	Silty clay loam	CL	A–7	
		8–24	Clay	CH or MH	A–7	
		24–30	Clay loam	CL	A–6	
		30–42	Loamy fine sand	SM	A–2	
		42–60	Fine sand	SP	A–3	

[1] In many areas the pH of the surface layer is higher than the value given because of liming practices used in farming.

[2] Soils are subject to flooding, ponding, or occasional flooding of short duration.

Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or with material having this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, and that protective measures are needed if steel and more resistant concrete structures are placed in the soil.

Other soil properties significant to engineering uses are depth to bedrock and subsidence. Most soils in the survey area are deep enough over bedrock that bedrock generally does not affect their use. Some soils, however, are underlain by dolomite at comparatively shallow depths: Ritchey soils at a depth of 10 to 20 inches and Knowles and Ripon soils at a depth of 20 to 40 inches. Partly weathered, weakly cemented sandstone is at a depth of 20 to 40 inches in Gotham, sandstone substratum, and Urne soils.

Subsidence is settlement of organic soils or of soils containing the semifluid mineral layers. Ratings of soils for subsidence take into account the rapid initial

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction[3]	Shrink-swell potential	Corrosivity of—	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
85–95	70–80	60–70	30–40		NP	2.0–6.0	0.11–0.13	7.4–7.8	Low	Low	Low.
30–40	25–35	20–30	2–7		NP	>20.0	[4]	7.9–8.4	Low	Low	Low.
90–100	85–95	60–70	30–40	10–20	2–6	0.6–2.0	0.13–0.15	7.4–7.8	Low	Low	Low.
95–100	95–100	90–100	70–80	25–35	11–20	0.6–2.0	0.15–0.15	7.4–7.8	Moderate	Moderate	Low.
80–90	75–85	60–70	30–40		NP	0.6–2.0	0.08–0.10	6.6–8.4	Low	Low	Low.
	100	90–100	70–90	20–30	1–5	0.6–2.0	0.22–0.24	7.4–7.8	Low	Low	Low.
	100	90–100	70–90	20–29	5–12	0.6–2.0	0.20–0.22	5.6–7.3	Moderate	Moderate	Moderate.
90–100	85–95	60–70	30–40	20–29	6–10	2.0–6.0	0.11–0.13	6.1–6.5	Low	Low	Moderate.
80–90	75–85	60–70	30–40		NP	2.0–6.0	0.08–0.10	7.9–8.4	Low	Low	Low.
100	95–100	85–95	60–75	10–19	0–5	0.6–2.0	0.20–0.22	6.1–7.3	Low	Low	Low.
100	95–100	90–100	45–80	25–35	11–20	0.6–2.0	0.15–0.19	6.1–6.5	Moderate	Moderate	Low.
100	95–100	90–100	70–90	15–25	2–7	0.6–2.0	0.20–0.22	7.5–8.4	Low	Low	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.1–6.5	Low	Low	Moderate.
100	90–100	65–80	1–5		NP	6.0–20.0	0.06–0.08	6.6–7.3	Low	Low	Low.
	100	90–100	75–95	50–59	30–32	0.06–0.2	0.09–0.11	6.1–6.5	High	High	Low.
	100	95–100	90–95	40–49	23–29	0.06–0.2	0.10–0.12	7.4–7.8	High	High	Low.
100	90–100	65–85	15–25		NP	2.0–6.0	0.10–0.12	6.1–6.5	Low	Low	Moderate.
90–100	85–95	60–70	30–40	10–20	2–6	2.0–6.0	0.15–0.17	5.1–6.5	Low	Low	High.
						6.0–20.0	0.25–0.35	6.6–7.8		High	Low.
	100	90–100	75–95	50–59	30–32	0.06–0.2	0.09–0.11	7.4–8.4	High	High	Low.
	100	95–100	85–95	40–50	20–30	0.6–2.0	0.21–0.23	5.6–6.0	Moderate	High	Moderate.
	100	90–100	75–95	50–90	30–60	0.06–0.2	0.09–0.11	6.1–7.3	High	High	Low.
95–100	95–100	90–100	70–80	25–40	11–20	0.6–2.0	0.15–0.19	6.6–7.3	Moderate	High	
100	90–100	65–95	15–25		NP	6.0–20.0	0.09–0.11	6.6–7.3	Low	High	Low.
100	90–100	65–80	1–5		NP	6.0–20.0	0.05–0.07	7.4–7.8	Low	High	Low.

[3] NP means nonplastic.

[4] The roots of most plants are excluded from this layer, and the water is not available for use by plants.

loss of elevation resulting from drainage and lowering the level of the ground water, and the later and slower loss of elevation that results from the oxidation of organic materials. The maximum possible loss of surface elevation is called *potential subsidence*. Only the organic soils are subject to subsidence, if drained. These are Adrian, Edwards, Houghton, Palms, and Willette soils. Subsidence of these soils is approximately ½ to 1 inch per year, if drained.

Land use interpretations

The interpretations in tables 10 and 11 are based on the estimated engineering properties of soils shown in table 9, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Green Lake County. In table 10, the soils are rated according to their limitations or suitability for engineering projects such as sewage lagoons and landfills and as a source of road fill, sand and gravel, and topsoil. Table 11 rates the soils on their suitability for water management structures.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally favorable for the rated use or, in other words, that limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties so unfavorable and so difficult to correct or overcome that major soil reclamation and special designs are required. For some uses, the rating of severe is divided to obtain ratings of severe and very severe. *Very severe* means one or more soil properties so unfavorable for a particular use that to overcome limitations is most difficult and costly and commonly not practical for the rated use.

TABLE 10.—*Interpretations of*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Adrian: Ad	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; rapid permeability; frequent flooding.	Very severe: high water table; sidewall instability; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Alluvial land, wet: An	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.
Barry: Bb	Severe: high water table; frequent flooding.	Severe: high water table; gravelly substratum has moderately rapid permeability; stones.	Severe: high water table; stones.	Severe: high water table; stones.
Boyer: BpB, BpC2, BpD	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: very rapidly permeable sand and gravel substratum.	Severe: sand and gravel substratum that has sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Brems: BrB	Severe: seasonal high water table.	Severe: high water table; very rapid permeability.	Severe: high water table; sidewall instability.	Severe: high water table.
Briggsville: BsA, BsB	Severe: moderately slow permeability; seasonal high water table in places.	Slight where slope is 0 to 2 percent, moderate where slope is 2 to 6 percent.	Severe: clayey, difficult to work.	Severe: high shrink-swell potential; medium to low shear strength.
Colwood: Co	Severe: high water table; frequent flooding.	Severe: high water table; moderately permeable; frequent flooding.	Severe: high water table; frequent flooding; sidewall instability.	Severe: high water table; frequent flooding; medium shear strength to low shear strength.
Dodge: DdB, DdC2	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: seepage.	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Moderate: moderate shrink-swell potential; low strength; slope.
Edwards: Ed	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; frequent flooding.	Very severe: high water table; frequent flooding; sidewall instability.	Very severe: high water table; frequent flooding; susceptible to frost action; low strength.
Friesland: FoA, FoB	Slight or moderate: seasonal high water table in places.	Moderate: moderate permeability.	Slight	Slight or moderate: seasonal high water table in places.
Gotham: GaB, GaC, GbC, GbD.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: rapid permeability; seepage.	Severe: sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.
Granby: Gf	Severe: high water table; rapid permeability; frequent flooding.	Severe: high water table; rapid permeability; frequent flooding.	Severe: high water table; sidewall instability; frequent flooding.	Severe: high water table; frequent flooding.

See footnotes at end of table.

engineering properties of the soils

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Very severe: high water table; rapid permeability; organic material; frequent flooding.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material; susceptible to frost action.	Poor: poorly graded sand in substratum; excess fines; high water table.	Poor: oxidizes rapidly; high water table.
Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding; loamy areas highly susceptible to frost action.	Poor: high water table; loamy areas highly susceptible to frost action.	Fair where sandy areas are poorly graded and have some fines, unsuited where loamy areas have excess fines.	Poor: high water table.
Severe: high water table; moderately rapid permeability in substratum; stones.	Severe: high water table; susceptible to frost action; stones.	Poor: high water table; stones.	Unsuited	Poor: high water table.
Severe: very rapid permeability in substratum; stones.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent; stones.	Good where slope is 1 to 12 percent, fair where slope is more than 12 percent: stones.	Good: poorly graded sand in substratum, fair for gravel in areas where gravel is in substratum.	Poor: sandy.
Severe: sandy; very rapid permeability.	Slight	Good	Good: poorly graded sand.	Poor: sandy.
Moderate: clayey, difficult to work; seasonal high water table in places.	Severe: high shrink-swell potential.	Poor: high shrink-swell potential.	Unsuited: fines	Fair: thin layer.
Severe: high water table; frequent flooding.	Severe: high water table; highly susceptible to frost action; medium shear strength to low shear strength.	Poor: high water table; susceptible to frost action; medium shear strength to low shear strength.	Unsuited: fines	Poor: high water table.
Slight	Moderate: susceptible to frost action; moderate shrink-swell potential.	Fair: moderate shrink-swell potential; susceptible to frost action.	Unsuited for sand, poor for gravel; fines.	Fair where slope is 2 to 6 percent, poor where slope is more than 6 percent: thin layers.
Very severe: high water table; frequent flooding; subsoil is organic material.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material; susceptible to frost action.	Unsuited: fines	Poor: oxidizes rapidly; high water table.
Slight or moderate: seasonal high water table in places.	Moderate: low strength; susceptible to frost action.	Fair: susceptible to frost action.	Unsuited: fines	Good.
Severe: rapid permeability; seepage; sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good	Good source of sand: the sandstone that underlies some areas of these soils is a good source of silica sand. Not suitable for gravel.	Poor: too sandy.
Severe: high water table; rapid permeability; frequent flooding.	Severe: high water table; frequent flooding.	Poor: high water table.	Good source of sand, unsuited for gravel.	Poor: high water table; too sandy.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Granby, loamy subsoil variant: GhA.	Severe: high water table; rapid permeability in the upper part and moderate permeability in the lower part; frequent flooding.	Severe: high water table; rapid permeability in the upper part, and moderate permeability in the lower part; frequent flooding.	Severe: high water table; sidewall instability; frequent flooding.	Severe: high water table; frequent flooding.
Granby, clayey subsoil variant: GkA.	Severe: high water table; rapid permeability in the upper part and slow permeability in the lower part; frequent flooding.	Severe: high water table; rapid permeability in the upper part, and slow permeability in the lower part; frequent flooding.	Severe: high water table; sidewall instability; frequent flooding.	Severe: high water table; frequent flooding.
Grellton: GnA, GnB, GnC2, GnD2.	Slight or moderate where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: seasonal high water table in places.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Slight or moderate where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: seasonal high water table in places.
Griswold: GrA, GrB, GrC2	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.
Houghton: Ho	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; rapid permeability; frequent flooding.	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Joy: JoA	Severe: seasonal high water table; ponding.	Severe: seasonal high water table.	Severe: seasonal high water table.	Severe: seasonal high water table.
Kibbie: KbA	Severe: seasonal high water table; ponding.	Severe: seasonal high water table.	Severe: seasonal high water table; sidewall instability.	Severe: seasonal high water table; medium shear strength to low shear strength.
Kidder: KdA, KdB, KdC2, KdD2, KeA, KeB, KeC2, KeD2, KeE.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent: stones.	Moderate where slope is 0 to 12 percent, severe where slope is more than 12 percent: stones.
Knowles: KwA, KwB, KwC2 KwD2.	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: dolomite bedrock near the surface.	Severe: dolomite bedrock near the surface.
Lapeer: LaB, LaC2, LaD2 Lb	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent: moderate permeability; seepage.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 0 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.

See footnotes at end of table.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Severe: high water table; rapid permeability in the upper part, and moderate permeability in the lower part; frequent flooding.	Severe: high water table; frequent flooding.	Poor: high water table.	Unsuited: fines	Poor: high water table; too sandy.
Severe: high water table; rapid permeability in the upper part and slow permeability in the lower part; frequent flooding.	Severe: high water table; frequent flooding.	Poor: high water table; clayey subsoil has medium shear strength or low shear strength and high shrink-swell potential.	Unsuited: fines	Poor: high water table; too sandy.
Slight or moderate where slope is 0 to 12 percent, moderate where slope is more than 12 percent; seasonal high water table in places.	Moderate: medium shear strength to low shear strength; susceptible to frost action.	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent: susceptible to frost action.	Unsuited: fines	Good where slope is 0 to 6 percent, fair where slope is 6 to 12 percent, poor where slope is more than 12 percent.
Slight: stones	Moderately susceptible to frost action; stones.	Fair: susceptible to frost action; stones.	Unsuited: fines	Good where slope is 0 to 6 percent, fair where slope is more than 6 percent.
Very severe: high water table; rapid permeability; organic material; frequent flooding.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material; susceptible to frost action.	Unsuited: fines	Poor: oxidizes rapidly; high water table.
Severe: seasonal high water table.	Severe: seasonal high water table; susceptible to frost action.	Poor: susceptible to frost action.	Unsuited: fines	Good.
Severe: seasonal high water table; sidewall instability.	Severe: seasonal high water table; susceptible to frost action.	Poor: susceptible to frost action; medium shear strength to low shear strength.	Unsuited: fines	Good.
Slight where slope is 0 to 12 percent, moderate where slope is 12 to 20 percent, severe where slope is more than 20 percent: stones.	Moderate where slope is 0 to 12 percent, severe where slope is more than 12 percent: susceptible to frost action.	Fair where slope is 0 to 20 percent, poor where slope is more than 20 percent: susceptible to frost action.	Unsuited: fines	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent: thin layer.
Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: susceptible to frost action; dolomite bedrock near the surface.	Poor: susceptible to frost action: dolomite bedrock near the surface.	Unsuited: dolomite bedrock near the surface.[2]	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent: thin layer.
Slight where slope is 0 to 12 percent, moderate where slope is more than 12 percent, severe where slope is more than 12 percent: stones.	Moderate where slope is 0 to 12 percent, severe where slope is more than 12 percent: susceptible to frost action.	Fair where slope is 0 to 12 percent, poor where slope is more than 12 percent: susceptible to frost action; stones.	Unsuited: fines	Good for fine sandy loam, poor for loamy fine sand: too sandy.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
LeRoy: LrC2, LrD2	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Severe: moderate permeability; slope; stones.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Lomira: LvB, LvC2, LvD2	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: moderate permeability.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Manawa: MaA	Severe: seasonal high water table; slow permeability; occasional flooding.	Severe: seasonal high water table; occasional flooding.	Severe: seasonal high water table; too clayey; occasional flooding.	Severe: seasonal high water table; high shrink-swell potential; occasional flooding.
Marcellon: McA	Severe: seasonal high water table; occasional flooding.	Severe: seasonal high water table; occasional flooding; stones.	Severe: seasonal high water table; occasional flooding; stones.	Severe: seasonal high water table; occasional flooding; stones.
Markesan: MdB2, MdC2, MdD2.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
Marsh: Mf	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.
Marshan: Mh	Severe: high water table; flooding common.	Severe: high water table; flooding common.	Severe: high water table; flooding common; sidewall instability.	Severe: high water table; flooding common; sidewall instability.
Mecan: MnB, MnC2	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 6 percent.	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.	Slight where slope is 2 to 6 percent, moderate where slope is more than 6 percent.
Mendota: MsA, MsB, MsC2	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: stones.
Oakville: OaB, OaC, OaD	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: very rapid permeability.	Severe: sidewall instability; slope.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.

See footnotes at end of table.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Slight where slope is 6 to 12 percent, moderate where slope is more than 12 percent: stones.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: susceptible to frost action; moderate shrink-swell potential.	Fair where slope is 6 to 12 percent, poor where slope is more than 12 percent: medium shear strength; susceptible to frost action.	Unsuited for sand, poor for gravel: fines.	Fair where slope is 6 to 12 percent, poor where slope is more than 12 percent: thin layer.
Slight where slope is 2 to 12 percent, moderate where slope is more than 12 percent: stones.	Severe: susceptible to frost action.	Poor: susceptible to frost action.	Unsuited for sand, poor for gravel: fines.	Fair where slope is 2 to 12 percent, poor where slope is more than 12 percent: fine layer.
Severe: seasonal high water table; too clayey; occasional flooding.	Severe: seasonal high water table; occasional flooding; high shrink-swell-potential; susceptible to frost action.	Poor: seasonal high water table; high shrink-swell potential; susceptible to frost action.	Unsuited: fines	Fair: thin layer.
Severe: seasonal high water table; occasional flooding: stones.	Severe: seasonal high water table; occasional flooding; susceptible to frost action.	Fair: seasonal high water table; susceptible to frost action.	Poor: fines	Good.
Slight where slope is 2 to 12 percent, moderate where slope is more than 12 percent; stones.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: susceptible to frost action.	Fair where slope is 2 to 12 percent, poor where slope is more than 12 percent: medium shear strength to low shear strength; susceptible to frost action.	Unsuited for sand, poor for gravel: fines.	Fair where slope is 2 to 12 percent, poor where slope is more than 12 percent: thin layer.
Very severe: high water table; frequent flooding.	Very severe: high water table; frequent flooding.	Very poor: high water table; susceptible to frost action.	Unsuited: fines	Poor: high water table.
Severe: high water table; flooding common.	Severe: high water table; susceptible to frost action; flooding common.	Poor: high water table; susceptible to frost action.	Fair for sand, unsuited for gravel: fines.	Poor: high water table.
Severe where the substratum is loamy sand: moderately rapid permeability; seepage; stones. Moderate where the substratum is sandy loam: stones.	Slight	Fair	Poor for sand, unsuited for gravel: fines.	Poor: too sandy.
Slight: stones	Severe: susceptible to frost action.	Poor: susceptible to frost action.	Unsuited for sand, poor for gravel: fines.	Good where slope is 0 to 6 percent, fair where slope is more than 6 percent.
Severe: very rapid permeability.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good where slope is 1 to 12 percent, fair where slope is 12 to 20 percent, severe where slope is more than 20 percent.	Good for sand, unsuited for gravel: fines.	Poor: too sandy; reclamation of borrow site difficult.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Okee: OkB, OkC	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Severe: moderately rapid permeability in sandy upper layers.	Moderate where slope is 1 to 12 percent, severe where slope is more than 12 percent: sidewall instability.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.
Oshtemo: OmB, OmC2	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.[1]	Severe: very rapidly permeable sand substratum.	Severe: sand substratum has sidewall instability; stones.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent: stones.
Ossian: Os	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.
Palms: Pa	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; rapid permeability in the organic layer; frequent flooding.	Very severe: high water table; sidewall instability; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Plano: PnA, PnB	Slight or moderate: seasonal high water table in places.	Moderate: moderate permeability; seasonal high water table in places.	Slight: seasonal high water table in places.	Slight: seasonal high water table in places.
Poy: Pr	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; clayey subsoil; sandy substratum that has sidewall instability.	Severe: high water table; high shrink-swell potential; frequent flooding.
Poygan: Py	Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding.	Severe: high water table; clayey subsoil; frequent flooding.	Severe: high water table; high shrink-swell potential; frequent flooding.
Richford: RaB, RaC	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.[1]	Severe: moderately rapid permeability; seepage.	Severe: sidewall instability; stones.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent; stones.
Ripon: ReB	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: dolomite bedrock near the surface.	Severe: dolomite bedrock near the surface.
Ritchey: RhB2, RhC2, RhD2	Severe: fractured dolomite bedrock at a depth of 10 to 20 inches; slope.	Severe: fractured dolomite bedrock at a depth of 10 to 20 inches; slope.	Severe: dolomite bedrock near the surface.	Severe: dolomite bedrock near the surface.
Rock land and Ritchey: RkE.	Severe: fractured dolomite bedrock at or near the surface; slope.	Severe: fractured dolomite bedrock at or near the surface; slope.	Severe: dolomite bedrock at or near the surface; slope.	Severe: dolomite bedrock at or near the surface; slope.

See footnotes at end of table.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Slight where slope is 1 to 12 percent, moderate where slope is more than 12 percent.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.	Good where slope is 1 to 12 percent, fair where slope is more than 12 percent.	Poor for sand, unsuited for gravel: fines.	Poor: too sandy.
Severe: very rapidly permeable sand substratum.	Slight where slope is 1 to 6 percent, moderate where slope is more than 6 percent.	Good	Good: poorly graded sand in substratum; fair for gravel in lower part of subsoil and in substratum in some areas of this soil.	Poor: sandy.
Severe: high water table; frequent flooding.	Severe: high water table; frequent flooding; susceptible to frost action.	Poor: medium shear strength to low shear strength; susceptible to frost action.	Unsuited: fines	Poor: high water table.
Very severe: high water table; rapid permeability; subsoil is organic material; frequent flooding.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material susceptible to frost action.	Unsuited: fines	Poor: oxidizes rapidly; high water table.
Moderate	Severe: susceptible to frost action.	Poor: susceptible to frost action; moderate shrink-swell potential.	Unsuited: fines	Good.
Severe: high water table; clayey subsoil; frequent flooding; sandy substratum has sidewall instability.	Severe: high water table; high shrink-swell potential; susceptible to frost action; medium shear strength to low shear strength.	Poor: high water table; high shrink-swell potential; medium shear strength to low shear strength; susceptible to frost action.	Good for sand; unsuited for gravel; fines.	Poor: high water table; too clayey.
Severe: high water table; clayey subsoil; frequent flooding.	Severe: high water table; high shrink-swell potential; susceptible to frost action; medium shear strength to low shear strength.	Poor: high water table; high shrink-swell potential; medium shear strength to low shear strength; susceptible to frost action.	Unsuited: fines	Poor: high water table; thin layer; clayey.
Severe: moderately rapid permeability in subsoil; rapid permeability in substratum; seepage.	Slight where slope is 1 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good	Good source of sand; unsuited for gravel; fines.	Poor: too sandy.
Severe: fractured dolomite bedrock at a depth of 20 to 40 inches.	Severe: susceptible to frost action; dolomite bedrock near the surface.	Poor: susceptible to frost action; dolomite bedrock near the surface.	Unsuited: dolomite bedrock near the surface.[2]	Good.
Severe: fractured dolomite bedrock at a depth of 10 to 20 inches.	Severe: susceptible to frost action; dolomite bedrock near the surface.	Poor: susceptible to frost action; dolomite bedrock near the surface.	Unsuited: dolomite bedrock near the surface.[2]	Poor: thin layer.
Severe: fractured dolomite bedrock at or near the surface; slope.	Severe: dolomite bedrock at or near the surface; slope.	Poor: dolomite bedrock at or near the surface; slope.	Unsuited: dolomite bedrock near or at the surface.[2]	Poor: thin layer; many dolomite bedrock outcrops; slope.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption field	Sewage lagoons	Shallow excavations	Dwellings with basement
Rock outcrop: Ro	Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.
Rodman: RsD, RsE	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: very rapid permeability.[1]	Severe: very rapid permeability in sand and gravel substratum; slope.	Severe: sand and gravel substratum that has sidewall instability.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.
Rotamer: RtB2, RtC2, RtD2, RtE.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent: stones.
St. Charles: ScA, ScB, ScC2	Slight or moderate where slope is 0 to 6 percent, moderate where slope is more than 6 percent: seasonal high water table in places.	Moderate where slope is 0 to 6 percent, severe where slope is more than 6 percent.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: seasonal high water table in places.	Slight where slope is 0 to 6 percent, moderate where slope is more than 6 percent: seasonal high water table in places.
Sisson: SnB, SnC2, SnD2	Slight where slope is 2 to 6 percent, moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Moderate where slope is 2 to 6 percent, severe where slope is more than 12 percent.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: sidewall instability.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: low strength.
Tustin: TuB	Severe: rapid permeability in upper part of subsoil; slow permeability in lower part of subsoil and in substratum.	Severe: rapid permeability in upper part of subsoil.	Severe: clayey subsoil and substratum; difficult to work.	Severe: high shrink-swell potential in substratum.
Urne: UrB, UrC2, UrD2	Severe: weakly cemented sandstone at a depth of 20 to 40 inches; moderately rapid permeability.	Severe: weakly cemented sandstone at a depth of 20 to 40 inches; moderately rapid permeability.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent; weakly cemented sandstone bedrock at a depth of 20 to 40 inches.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: weakly cemented sandstone bedrock at a depth of 20 to 40 inches.
Willette: We	Very severe: high water table; frequent flooding.	Very severe: high water table; organic material; frequent flooding.	Very severe: high water table; sidewall instability; frequent flooding.	Very severe: high water table; frequent flooding; susceptible to frost action.
Zittau: ZtA	Severe: seasonal high water table; slow permeability in subsoil; occasional flooding.	Severe: seasonal high water table; occasional flooding; rapid permeability in substratum.	Severe: seasonal high water table; clayey subsoil; sandy substratum that has sidewall instability.	Severe: seasonal high water table; high shrink-swell potential; occasional flooding.

[1] Poor filtering materials may cause contamination of nearby water supplies.

properties of the soils—Continued

Degree and kind of limitation for—Continued		Suitability as source of—		
Trench-type sanitary landfill	Roads and streets	Road fill	Sand and gravel	Topsoil
Severe: igneous bedrock at the surface; slope.	Severe: igneous bedrock at the surface; slope.	Unsuited: igneous bedrock at the surface.	Unsuited: igneous bedrock at the surface.	Unsuited: igneous bedrock at the surface.
Severe: very rapid permeability; slope.	Moderate where slope is 6 to 12 percent, severe where slope is more than 12 percent.	Good where slope is 6 to 12 percent, fair where slope is 12 to 20 percent, poor where slope is more than 20 percent.	Good: poorly graded gravel in substratum.	Poor: thin layer; gravelly.
Slight where slope is 2 to 12 percent, moderate where slope is 12 to 20 percent, severe where slope is more than 20 percent: stones.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: stones.	Fair where slope is 2 to 20 percent, poor where slope is more than 20 percent: susceptible to frost action.	Poor for sand and gravel: fines.	Fair where slope is 2 to 12 percent, poor where slope is more than 12 percent: thin layer.
Slight	Severe: susceptible to frost action.	Poor: susceptible to frost action; moderate shrink-swell potential.	Unsuited: fines	Fair: thin layer.
Slight where slope is 2 to 12 percent, moderate where slope is more than 12 percent.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: susceptible to frost hazard; low strength.	Fair: susceptible to frost action.	Unsuited: fines	Good where slope is 2 to 6 percent, fair where slope is 6 to 12 percent, poor where slope is more than 12 percent.
Moderate: clayey subsoil and substratum; difficult to work.	Slight	Poor: thin layer; clayey subsoil and substratum has high shrink-swell potential.	Poor for sand, unsuited for gravel: fines.	Poor: sandy; reclamation of borrow site difficult.
Severe: moderately rapid permeability; weakly cemented sandstone bedrock at a depth of 20 to 40 inches.	Moderate where slope is 2 to 12 percent, severe where slope is more than 12 percent: weakly cemented sandstone bedrock at a depth of 20 to 40 inches.	Fair where slope is 2 to 20 percent, severe where slope is more than 20 percent: thin layer over weakly cemented sandstone bedrock.	Poor for sand: excess fines; the underlying sandstone is a possible source of silica sand.	Good where slope is 2 to 6 percent, fair where slope is 6 to 12 percent, severe where slope is more than 12 percent.
Very severe: high water table; rapid permeability; subsoil is organic material; frequent flooding.	Very severe: high water table; susceptible to frost action; low strength in organic material.	Very poor: high water table; organic material; susceptible to frost action.	Unsuited	Poor: oxidizes rapidly; high water table.
Severe: seasonal high water table; clayey subsoil; occasional flooding; sandy substratum that has sidewall instability.	Severe: seasonal high water table; susceptible to frost action; high-shrink-swell potential; medium shear strength to low shear strength.	Poor: seasonal high water table; high shrink-swell potential; medium shear strength to low shear strength; susceptible to frost action.	Good for sand; unsuited for gravel.	Poor: thin layer; too clayey.

[2] Source of dolomite limestone for crushing.

TABLE 11.—*Soil features affecting water management*

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Adrian: Ad	Rapid permeability; high water table.	Organic layer compressible, hard to pack; high permeability of compacted soil material in substratum.	High water table; rapid permeability; unstable when wet; frequent flooding.	High available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.
Alluvial land, wet: An	Variable permeability; frequent flooding; high water table.	Low to medium shear strength; medium to high permeability of compacted soil material; piping hazard.	High water table; variable permeability; frequent flooding; unstable when wet; ponding in places.	High to low available water capacity; variable permeability; poorly drained; frequent flooding.	Slope is 0 to 2 percent; poorly drained; frequent flooding.
Barry: Bb	Moderate permeability in subsoil, moderately rapid permeability in substratum; high water table.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; stones.	High water table; moderate permeability in subsoil, moderately rapid permeability in substratum; ponding.	High available water capacity; moderate permeability; poorly drained; stones.	Slope is 0 to 2 percent; poorly drained; calcareous till at a depth of 24 to 40 inches; stones.
Boyer: BpB, BpC2, BpD	Moderately rapid permeability in subsoil; very rapid permeability in substratum; slope.	Medium shear strength; medium to low permeability of compacted material; seepage; piping hazard; stones.	Natural drainage is adequate.	Low available water capacity; moderately rapid permeability; soil blowing hazard; stones; slope.	Slope is 1 to 25 percent; complex slopes; sandy; may be difficult to vegetate; soil blowing hazard; sand and gravel at a depth of 24 to 40 inches; stones.
Brems: BrB	Very rapid permeability.	Medium shear strength; medium permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	Low available water capacity; very rapid permeability; soil blowing hazard.	Slope is 0 to 6 percent; sandy; difficult to vegetate; soil blowing hazard.
Briggsville: BsA, BsB	Moderately slow permeability; slope.	Medium to low shear strength; low permeability of compacted soil material; high shrink-swell potential.	Natural drainage is adequate.	Moderate available water capacity; moderately slow permeability; slope.	Slope is 0 to 6 percent; clayey subsoil; moderately slow permeability; slope.
Colwood: Co	Moderate permeability; high water table.	Medium to low strength; piping hazard.	High water table; moderately permeable; sidewall instability; susceptible to frost action.	Very high available water capacity; poorly drained; moderate permeability.	Slope is 0 to 2 percent; poorly drained.
Dodge: DdB, DdC2	Moderate permeability; seepage.	Medium to low shear strength; medium permeability to low permeability of compacted soil; piping hazard; stones in substratum.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 2 to 12 percent; complex slopes; erodes easily; calcareous till at a depth of 28 to 40 inches.
Edwards: Ed	Rapid permeability in organic layer, slow permeability in substratum; high water table.	Organic layer compressible, hard to pack; low permeability of compacted material in substratum.	High water table; rapid permeability in organic layer, slow permeability in substratum; frequent flooding.	Very high available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Friesland: FoA, FoB	Moderate permeability; seepage.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 0 to 6 percent; complex slopes.
Gotham: GaB, GaC, GbC, GbD.	Rapid permeability; seepage.	Medium shear strength; medium to low permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	Low available water capacity; rapid permeability; soil blowing hazard; slope.	Slope is 1 to 20 percent; sandy; difficult to vegetate; blowing hazard; weakly cemented sandstone at a depth of 24 to 39 inches in some areas of this soil.
Granby: Gf	Rapid permeability; high water table.	Medium shear strength; high permeability of compacted soil material; piping hazard.	High water table; rapid permeability; unstable when wet.	Low available water capacity; poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; poorly drained; sandy; difficult to vegetate; blowing hazard.
Granby, loamy subsoil variant: GhA.	Rapid permeability; high water table.	Medium shear strength; medium to low permeability of compacted soil material; piping hazard.	High water table; rapid permeability in sandy part and moderate permeability in loamy part; unstable when wet.	Moderate available water capacity; rapid permeability in sandy part and moderate permeability in loamy part; poorly drained; blowing hazard.	Slope is 0 to 3 percent; poorly drained; difficult to vegetate; soil blowing hazard.
Granby, clayey subsoil variant: GkA.	Rapid permeability; high water table.	Medium shear strength in sandy part; medium to low shear strength in clayey part; medium to low permeability of compacted soil material; piping hazard.	High water table; rapid permeability in sandy part and slow permeability in clayey part; unstable when wet.	Moderate available water capacity; rapid permeability in sandy part and slow permeability in clayey part; poorly drained; soil blowing hazard.	Slope is 0 to 3 percent; poorly drained; difficult to vegetate; soil blowing hazard.
Grellton: GnA GnB, GnC2, GnD2.	Moderate permeability; slope; seepage.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	High available water capacity; moderate permeability; soil blowing hazard; slope.	Slope is 0 to 20 percent; complex slopes; soil blowing hazard.
Griswold: GrA, GrB, GrC2.	Moderate permeability; slope; stones.	Medium shear strength; fair to good compaction; stones; piping hazard.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 0 to 12 percent; complex slopes; calcareous till at a depth of 24 to 40 inches; stones.
Houghton: Ho	Rapid permeability.	Compressible, hard to pack; low shear strength.	High water table; rapid permeability; frequent flooding.	Very high available water capacity; very poorly drained; rapid permeability; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Joy: JoA	Moderate permeability; seasonal high water table.	Medium to low shear strength; medium to low permeability of compacted soil material.	Seasonal high water table; moderate permeability; ponding.	Very high available water capacity; moderate permeability; somewhat poorly drained.	Slope is 0 to 3 percent; somewhat poorly drained.
Kibbie: KbA	Moderate permeability; seasonal high water table.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard.	Seasonal high water table; moderate permeability; unstable when wet.	High available water capacity; moderate permeability; somewhat poorly drained.	Slope is 0 to 3 percent; somewhat poorly drained.
Kidder: KdA, KdB, KdC2, KdD2, KeA KeB, KeC2, KeD2, KeE.	Moderate permeability; seepage; stones.	Medium to low shear strength; low permeability of compacted soil material; piping hazard; seepage; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; slope; stones.	Slope is 0 to 30 percent; complex slopes; calcareous till at a depth of 24 to 40 inches; stones; blowing hazard on fine sandy loam surface.
Knowles: KwA, KwB, KwC2, KwD2.	Moderate permeability; fractured dolomite bedrock at a depth of 20 to 40 inches; seepage.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; dolomite bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; dolomite bedrock at a depth of 20 to 40 inches; slope.	Slope is 0 to 20 percent; dolomite bedrock at a depth of 20 to 40 inches.
Lapeer: LaB, LaC2, LaD2, Lb.	Moderate permeability; slope; stones.	Medium to low shear strength; medium to low permeability of compacted soil material; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; stones; blowing hazard; slope.	Slope is 0 to 25 percent; complex slopes; calcareous till at a depth of 24 to 40 inches; stones; soil blowing hazard.
LeRoy: LrC2, LrD2	Moderate permeability; slope; stones.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; very gravelly till at a depth of 12 to 24 inches; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; stones; slope.	Slope is 6 to 20 percent; complex slopes; calcareous till at a depth of 12 to 24 inches; stones.
Lomira: LvB, LvC2, LvD2	Moderate permeability; slope.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; very gravelly till at a depth of 24 to 40 inches; stones.	Natural drainage is adequate	High available water capacity; moderate permeability; slope.	Slope is 2 to 20 percent; complex slopes; calcareous till at a depth of 24 to 40 inches.
Manawa: MaA	Slow permeability; seasonal high water table.	Medium to low shear strength; low permeability of compacted soil material.	Seasonal high water table; slow permeability; occasional flooding.	High available water capacity; slow permeability; somewhat poorly drained.	Slope is 0 to 3 percent; somewhat poorly drained; clayey subsoil.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Marcellon: McA	Moderate permeability; seasonal high water table; occasional flooding.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; stones.	Seasonal high water table; moderate permeability; stones.	High available water capacity; moderate permeability; somewhat poorly drained; stones.	Slope is 0 to 3 percent; somewhat poorly drained; calcareous till at a depth of 20 to 40 inches; stones.
Markesan: MdB2, MdC2, MdD2.	Moderate permeability; slope; stones.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; very gravelly till at a depth of 12 to 24 inches; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; stones; slope.	Slope is 2 to 20 percent; complex slopes; calcareous till at a depth of 12 to 24 inches; stones.
Marsh: Mf	Variable permeability; high water table; frequent flooding.	Variable characteristics; high water table; frequent flooding.	High water table; variable permeability; frequent flooding.	Variable characteristics; high water table; frequent flooding.	Slope is 0 to 2 percent; very poorly drained.
Marshan: Mh	Moderate permeability in subsoil; rapid permeability in substratum; high water table.	In subsoil, medium to low shear strength; medium to low permeability of compacted soil material. In substratum, medium shear strength and high permeability of compacted soil material; piping hazard.	High water table; moderate permeability in subsoil, rapid permeability in substratum; unstable when wet; ponding.	Moderate available water capacity; moderate permeability; poorly drained; sand at a depth of 24 to 40 inches.	Slope is 0 to 2 percent; poorly drained.
Mecan: MnB, MnC2	Moderate permeability; slope; stones.	Medium shear strength; medium to low permeability of compacted soil material; stones.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; stones; soil blowing hazard; slope.	Slope is 2 to 12 percent; complex slopes; calcareous till at a depth of 40 to 60 inches; soil blowing hazard; stones.
Mendota: MsA, MsB, MsC2.	Moderate permeability; slope.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; stones.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 0 to 12 percent; calcareous till at a depth of 24 to 40 inches.
Oakville: OaB, OaC, OaD	Very rapid permeability; slope.	Medium shear strength; medium to low permeability of compacted soil material; piping hazard.	Natural drainage is adequate.	Low available water capacity; very rapid permeability; soil blowing hazard; slope.	Slope is 1 to 35 percent; sandy; difficult to vegetate; soil blowing hazard.
Okee: OkB, OkC	Moderately rapid permeability in upper part and moderate permeability in lower part; slope.	Medium shear strength; medium to low permeability of compacted soil material; seepage; piping hazard; stones.	Natural drainage is adequate.	Moderate available water capacity; moderately rapid permeability in upper part; blowing hazard; slope.	Slope is 1 to 15 percent; sandy; difficult to vegetate; soil blowing hazard; complex slopes.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Oshtemo: OmB, OmC2	Moderately rapid permeability in subsoil; very rapid permeability in substratum; slope.	Medium shear strength; medium to low permeability of compacted soil material; seepage; piping hazard; stones.	Natural drainage is adequate.	Moderate available water capacity; moderately rapid permeability; soil blowing hazard; stones; slope.	Slope is 1 to 12 percent; sandy; may be difficult to vegetate; soil blowing hazard; sand or sand and gravel at a depth of 40 to 66 inches; stones.
Ossian: Os	Moderate permeability; high water table.	Medium to low shear strength; low permeability of compacted soil material.	High water table; moderate permeability; ponding.	Very high available water capacity; moderate permeability; poorly drained.	Slope is 0 to 2 percent; poorly drained; frequent flooding.
Palms: Pa	Rapid permeability in organic layer; moderate permeability in substratum; high water table.	Organic layer compressible, hard to pack; low strength; medium to low shear strength and medium to low permeability of compacted soil material in substratum.	High water table; rapid permeability in organic layer; unstable when wet; frequent flooding.	Very high available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.
Plano: PnA, PnB	Moderate permeability.	Medium to low shear strength; medium to low permeability of compacted soil material; stones in substratum.	Natural drainage is adequate.	Very high available water capacity; moderate permeability.	Slope is 0 to 6 percent.
Poy: Pr	Rapid permeability in substratum; high water table.	Medium to low shear strength; medium to low permeability of compacted subsoil material; high permeability of compacted soil material in substratum; piping hazard; high shrink-swell potential.	Slow permeability in subsoil, rapid permeability in substratum; high water table; ponding.	Moderate available water capacity; slow permeability; poorly drained.	Slope is 0 to 2 percent; poorly drained; clayey subsoil.
Poygan: Py	Slow permeability; high water table.	Medium to low shear strength; low permeability of compacted soil material; high shrink-swell potential.	Slow permeability; high water table; ponding.	Moderate available water capacity; slow permeability; poorly drained; slow intake rate.	Slope is 0 to 2 percent; poorly drained; clayey subsoil.
Richford: RaB, RaC	Moderately rapid permeability; seepage.	Medium shear strength; low to high permeability of compacted soil material; piping hazard; stones.	Natural drainage is adequate.	Low available water capacity; moderately rapid permeability; soil blowing hazard; slope; stones.	Slope is 1 to 15 percent; sandy; difficult to vegetate; soil blowing hazard; complex slopes; stones.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Ripon: ReB	Moderate permeability; fractured dolomite bedrock at a depth of 20 to 40 inches; seepage.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; dolomite bedrock at a depth of 20 to 40 inches.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; dolomite bedrock at a depth of 20 to 40 inches; slope.	Slope is 1 to 6 percent; dolomite bedrock at a depth of 20 to 40 inches; slope.
Ritchey: RhB2, RhC2, RhD2.	Moderate permeability; fractured dolomite bedrock at a depth of 10 to 20 inches.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; dolomite bedrock at a depth of 10 to 20 inches.	Natural drainage is adequate.	Low available water capacity; moderate permeability; dolomite bedrock at a depth of 10 to 20 inches; slope.	Slope is 2 to 20 percent; dolomite bedrock at a depth of 10 to 20 inches; slope.
Rock land and Ritchey: RkE.	Variable permeability; fractured dolomite bedrock at or near the surface; slope.	Dolomite bedrock at or near the surface; slope.	Natural drainage is adequate.	Variable available water capacity and permeability; dolomite bedrock at or near the surface; slope.	Slope is 6 to 45 percent; dolomite bedrock at or near the surface; rock outcrop.
Rock outcrop: Ro	Igneous bedrock at the surface; slope.	Igneous bedrock at the surface; slope.	Natural drainage is adequate.	Igneous bedrock at the surface.	Slope is 12 to 60 percent; igneous bedrock at the surface.
Rodman: RsD, RsE	Very rapid permeability.	Medium to high shear strength; high permeability of compacted soil material; seepage; piping hazard.	Natural drainage is adequate.	Very low available water capacity; very rapid permeability; gravelly sand and gravel at a depth of 8 to 15 inches; stones.	Slope is 6 to 35 percent; gravelly; sand and gravel at a depth of 8 to 15 inches; stones.
Rotamer: RtB2, RtC2, RtD2, RtE.	Moderate permeability; seepage; stones.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; seepage.	Natural drainage is adequate.	Moderate available water capacity; moderate permeability; slope; stones.	Slope is 2 to 30 percent; complex slopes; calcareous till at a depth of 12 to 24 inches; stones.
St. Charles: ScA, ScB, ScC2.	Moderate permeability.	Medium to low shear strength; medium to low permeability of compacted soil material; stones in substratum; slope.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 0 to 12 percent.
Sisson: SnB, SnC2, SnD2	Moderate permeability; slope.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; slope.	Natural drainage is adequate.	High available water capacity; moderate permeability; slope.	Slope is 2 to 20 percent.

TABLE 11.—*Soil features affecting water management*—Continued

Soil series and map symbols	Pond reservoir areas	Dikes, levees, and other embankments	Drainage for crops and pasture	Irrigation	Terraces and diversions
Tustin: TuB	Rapid permeability in upper part of subsoil; slow permeability in lower part of subsoil and in substratum.	Medium to low shear strength; medium to low permeability of compacted soil material; high shrink-swell potential in lower part of subsoil; piping in sand.	Natural drainage is adequate.	Low available water capacity; rapid permeability in upper part of subsoil, slow permeability in lower part of subsoil; soil blowing hazard.	Slope is 1 to 6 percent; sandy; difficult to vegetate; soil blowing hazard; clayey material at a depth of 20 to 40 inches.
Urne: UrB, UrC2, UrD2	Moderately rapid permeability; weakly cemented sandstone at a depth of 20 to 40 inches.	Medium to low shear strength; medium to low permeability of compacted soil material; piping hazard; thin layer over weakly cemented sandstone bedrock.	Natural drainage is adequate.	Low available water capacity; moderately rapid permeability; soil blowing hazard.	Slope is 2 to 30 percent; sandy; soil blowing hazard; cemented sandstone at a depth of 20 to 40 inches.
Willette: We	Rapid permeability in organic layer; slow permeability in substratum; high water table.	Organic layer compressible, hard to pack; low strength; substratum clayey, low to medium shear strength.	High water table; rapid permeability in organic layer; slow permeability in substratum; unstable when wet; frequent flooding.	Very high available water capacity; rapid permeability; very poorly drained; soil blowing hazard.	Slope is 0 to 2 percent; very poorly drained organic material.
Zittau: ZtA	Rapid permeability in substratum; seasonal high water table.	Medium to low shear strength; medium to low permeability of compacted subsoil material; high permeability of compacted substratum material; piping hazard; high shrink-swell potential.	Slow permeability in subsoil, rapid permeability in substratum; seasonal high water table; ponding.	Moderate available water capacity; slow permeability; somewhat poorly drained.	Slope is 0 to 3 percent; somewhat poorly drained; clayey subsoil.

The suitability of the soils as sources of road fill is rated by the terms *good*, *fair*, and *poor*, which have meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in tables 10 and 11.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that effect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs (4).

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor; its sides, or embankments, are of compacted soil material. The assumption is made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties that affect the pond floor are permeability, organic-matter content, and slope, and if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, for example, excavations for pipelines, sewer lines, phone and power

transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 10, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period (fig. 16). Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 10 apply only to a depth of about 6 feet, and ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet; nevertheless, every site should be investigated before it is selected for a landfill.

***Figure 16.*—Sanitary landfill in an area of Kidder soils. The underlying sandy loam glacial till is a good filter for removing harmful wastes and preventing pollution of the ground water.**

Roads and streets, as rated in table 10, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 5 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material or plant response when fertilizer is added to the soil; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments also affect suitability. Also considered in the ratings is damage that can result at the site from which topsoil is taken.

Pond reservoir areas, as described in table 11, hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic material in a soil are among factors that are unfavorable.

Drainage for crops and pasture is affected by the permeability, texture, and structure of the soil; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to flooding; alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as

slope; susceptibility to flooding by streams, water erosion, or soil blowing; soil texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures has outlets for runoff and is not difficult to vegetate.

Soil test data

Table 12 contains engineering test data for some of the major soil series in the county. The tests were made to help evaluate the soils for engineering purposes. The engineering classifications are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods.

Moisture-density data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as explained for table 9.

Formation and Classification of Soils

This section discusses the factors of soil formation and the differentiation of soil horizons. The current system of classifying soils is defined, and the soils of the county are classified according to that system.

Factors of Soil Formation

The factors that determine the kind of soil that forms at any given point are composition of the parent material; the climate under which the soil material has accumulated and weathered; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They alter the accumulated material and bring about the development of genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It largely determines the chemical and mineralogical composition of the soil.

Most of the soils in Green Lake County are derived from parent materials that are a direct or indirect result of the glacier. Even the soils that formed in material weathered over bedrock show some glacial influence in the rounded pebbles of mixed origin that they contain. Examples are Knowles and Ritchey soils that are on dolomite ridges and side slopes in the southern and eastern parts of the county. Adrian, Edwards, Houghton, Palms, and Willette soils that formed in decomposed vegetation and have very poor drainage result from the damming of earlier drainageways by glacial debris.

Glacial till, windblown silt, windblown sand, and lacustrine deposits are the most common parent materials. Glacial outwash, alluvium, colluvium, and residium from dolomite and sandstone are less common parent materials.

Glacial till is unstratified, unsorted glacial debris composed of clay, silt, sand, gravel, and boulders. This material underlies most of the well-drained soils except those in the northwestern part of the county.

There are two dominant kinds of till in Green Lake County. The most common till is gravelly sandy loam that is of mixed mineralogy. This till has two color phases, which probably represent different stages of glaciation. One color phase is yellowish brown moist, and the other is brown or reddish brown. The brown and reddish-brown till is probably associated with the Valders substage of glaciation and is the material pushed into the county during the last period of glaciation. Other than the difference in color, both tills are alike and contain 5 to 35 percent coarse fragments. Igneous boulders as much as 4 feet in diameter are not uncommon. Stone fences, which are made from the coarse fragments left in the surface layer by the glacier, are common in the areas underlain by glacial till. Some stony areas have never been cleared for cultivation.

Most of the till is gravelly sandy loam, but in some areas in the western part of the county it is gravelly loamy sand or loamy sand. Kidder, Lapeer, Mecan, and Rotamer soils commonly formed in this kind of till.

The other kind of till dominant in Green Lake County is very gravelly sandy loam. This till is mostly dolomite fragments and contains 30 to 60 percent coarse fragments. It has a high calcium carbonate equivalent. The angular dolomite fragments were gouged by the glacier from the underlying dolomite bedrock and probably never were moved far from the bedrock source. This till is limited to the high plain

in the southeastern part of the county. The lower subsoil of LeRoy, Lomira, Markesan, and Mendota soils formed in this kind of till.

Windblown silt mantles the high plain in the southeastern part of the county. Some of the best soils formed in windblown silt and the underlying glacial till. Dodge, Lomira, Mendota, Plano, and St. Charles soils commonly formed in these silts.

Windblown sands from the central sand plain of Wisconsin are common in the western parts of the county. This sand mantle extends into some parts of eastern Green Lake County, where it generally mantles an earlier soil that formed in glacial till. The sand is mostly fine and medium size sand, which indicates the distance that it has been blown from its source. The finer the particle size, the more readily it can be moved by the wind. This gradation in sand size is even noticeable going from west to east in Green Lake County. It is especially noticeable on the western margin of the high plain. The sand particles were evidently too heavy to reach the highest part of the plain, but approach silt size along its margin. Gotham and Oakville soils commonly formed in thick deposits of windblown sands. Okee soils formed in windblown sands mantling glacial till.

Lacustrine deposits consist mostly of stratified silt and fine sand, although there are some clayey deposits in the northern part of the county. These are sedimentary deposits that were laid down in the still water of old glacial lakes. Colwood, Kibbie, and Sisson soils commonly formed in stratified silt and fine sand. Poy and Zittau soils formed in clayey deposits over sands, and Briggsville, Manawa, and Poygan soils formed in clayey lacustrine deposits.

Glacial outwash is material deposited by water flowing from the melting glacier. The most valuable deposits are stratified sand and gravel (fig. 17). Much of the outwash in this county, however, is sandy and contains little or no gravel. Actually, it is difficult to assign a mode of origin to the sandy deposits that contain a small amount of gravel. Such sandy deposits generally show little evidence of stratification but contain too much gravel to be considered of windblown or lacustrine origin. The sandy deposits in most of the western part of the county probably have been reworked many times by glacial action.

Alluvial and colluvial deposits are of recent origin and the soils that formed in them do not have distinct horizons. These materials range from silty to sandy in texture and are deposited on stream bottoms and foot slopes by stream floods or local wash of soil materials from higher positions on the landscape. An example of alluvial deposits is Alluvial land, wet. Included in mapping the Joy, Ossian, and Plano soils are areas along natural drainageways that have 15 to 40 inches of silty alluvium and colluvium overlying a buried soil.

Residuum from weathered bedrock is another parent material. The two kinds of bedrock are dolomite and sandstone. The dolomite weathers to a firm and plastic, clayey residuum. This layer is thin or lacking in most places in Green Lake County because much of it was removed by the glacier, and since glaciation there has not been sufficient time for further weathering. In most places in the county the soils overlying

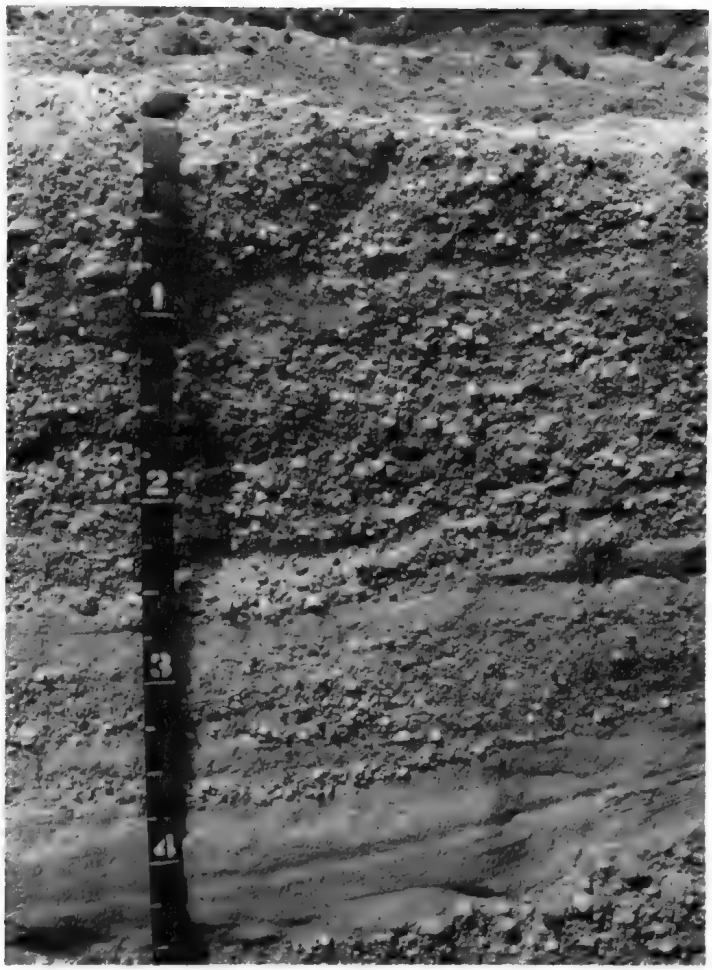

Figure 17.—**Gravel pit that exposes stratified sand and gravel.**

dolomite formed in windblown silts and glacial till and only a thin layer of residuum over the dolomite. Dolomite lies under the high plain in the southeastern part of the county and is exposed in many of the steep breaks or escarpments in this area. Isolated remnants of this dolomite cap are in all sections of the county except the northwestern corner. In most places the dolomite is covered by glacial till. Knowles, Ripon, and Ritchey soils are underlain by dolomite within a depth of 40 inches.

Sandstone weathers to sandy loam, loamy sand, or sand. In Green Lake County dolomite overlies the sandstone. The dolomite cap is quite hard and resists weathering, but the sandstone is relatively soft. Where the forces of geologic erosion have cut through the dolomite, the sandstone has also been completely removed or deep valleys have been cut. Green Lake, the deepest lake in Wisconsin, and Lake Puckaway were once connected and were part of a large glacial drainageway that has cut deeply into the sandstone bedrock.

Much of the loose sand in Green Lake County probably resulted from the grinding action of glacial ice on exposed sandstone. The acreage of soils that formed in sandstone residuum is not large because this bed-

TABLE 12.—*Engineering*

[Tests performed by Wisconsin Department

Soil name and location	Parent material	Depth	Moisture-density [1]		Mechanical analysis [2]		
			Maximum dry density	Optimum moisture	Percentage less than 3 inches passing sieve—		
					1 in	¾ in	⅜ in
		In	*Lb per cu ft*	*Pct*			
Boyer loamy fine sand: NE¼SE¼SE¼ sec. 25, T. 16 N., R. 11 E. (Modal profile)	Loamy drift and stratified sand and gravel.	9–19				100	96
		31–60			87	81	73
Briggsville silt loam: NW¼NE¼NE¼ sec. 2, T. 17 N., R. 13 E. (Modal profile)	Stratified clayey and loamy lacustrine material.	13–30					
		34–60	97.0	23.8			
Colwood silt loam: NE¼SW¼NW¼ sec. 15, T. 16 N., R. 13 E. (Modal profile)	Stratified loamy and sandy lacustrine material.	15–22					
		28–38					
Dodge silt loam: SW¼SW¼SE¼ sec. 6, T. 15 N., R. 13 E. (Modal profile)	Loess and gravelly sandy loam glacial till.	27–32					
		33–60			89	87	80
Friesland loam: SW¼SW¼NW¼ sec. 19, T. 15 N., R. 13 E. (Modal profile)	Loamy drift, silt loam aeolian material and gravelly sandy loam glacial till.	13–21					
		38–45					
		74–78			97	93	87
Kidder fine sandy loam: NW¼NE¼SE¼ sec. 3, T. 14 N., R. 11 E. (Modal profile)	Loamy drift and gravelly sandy loam glacial till.	11–26					
		34–60	135.2	7.9	95	94	91
Lapeer loamy fine sand: NE¼SW¼NE¼ sec. 24, T. 16 N., R. 11 E. (Modal profile)	Sandy and loamy drift and gravelly sandy loam glacial till.	12–21			94	93	91
		33–60			86	85	81
Mecan loamy fine sand: SE¼SW¼NW¼ sec. 33, T. 15 N., R. 11 E. (Modal profile)	Sandy and loamy drift and gravelly loamy sand glacial till.	35–42					
		46–60	133.0	7.7	92	90	88
Okee loamy fine sand: NW¼NE¼SW¼ sec. 26, T. 16 N., R. 11 E. (Modal profile)	Aeolian sand, loamy drift, and gravelly sandy loam glacial till.	10–25			99	99	96
		31–45					
		45–60	133.6	7.1	98	97	94
Ossian silt loam: SE¼SE¼NE¼ sec. 14, T. 14 N., R. 13 E. (The subsoil contains more clay than normal for the series.)	Loamy drift and calcareous silt loam.	11–20					
		39–55					
Plano silt loam: NW¼SE¼SE¼ sec. 11, T. 15 N., R. 13 E. (The underlying till contains more gravel than normal for the series.)	Loess and very gravelly sandy loam glacial till.	16–35					
		71–76			75	66	51
Poy silty clay loam: SE¼NW¼NE¼ sec. 11, T. 17 N., R. 13 E. (Modal profile)	Loamy and clayey deposits underlain by fine sand.	12–22					
		30–36					
Poygan silty clay loam: SE¼NE¼NE¼ sec. 1, T. 17 N., R. 13 E. (Modal profile)	Loamy and clayey lacustrine deposits.	18–30					
		33–47					

test data

of Transportation, Division of Highways]

Mechanical analysis [2]—Continued							Liquid limit [3]	Plasticity index [4]	Classification	
Percentage less than 3 inches passing sieve—Continued				Percentage smaller than—					AASHTO [5]	Unified
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
							Pct			
92	86	67	23	22	13	11	19.2	3.3	A–2–4(0)	SM
69	64	49	2	2	1	1	----------	[6] NP	A–1–b(0)	SP
----------	----------	100	97	97	77	49	61.0	35.6	A–7–6(20)	CH
----------	100	99	94	94	77	51	58.1	32.1	A–7–6(20)	CH
----------	100	98	68	64	34	28	36.8	20.2	A–6–(11)	CL
----------	100	98	83	81	34	18	25.6	8.7	A–4–(8)	CL
----------	100	95	57	52	32	27	33.8	17.8	A–6(7)	CL
75	69	62	33	28	9	6	----------	NP	A–2–4(0)	SM
----------	100	99	65	57	17	13	18.8	2.4	A–4–(6)	ML
----------	----------	100	97	92	32	24	37.9	17.5	A–6–(11)	CL
82	76	66	25	20	5	3	----------	NP	A–2–4(0)	SM
----------	100	94	39	38	23	19	22.9	8.7	A–4(1)	SC
89	88	79	35	32	11	8	----------	NP	A–2–4(0)	SM
90	89	80	31	25	11	9	----------	NP	A–2–4(0)	SM
78	76	69	21	19	8	6	----------	NP	A–2–4(0)	SM
----------	100	92	43	41	18	15	21.4	7.1	A–4(2)	SC–SM
86	85	77	22	19	8	6	----------	NP	A–2–4(0)	SM
93	91	82	12	10	5	3	----------	NP	A–2–4(0)	SP–SM
----------	100	92	29	27	16	14	----------	NP	A–2–4(0)	SM
91	89	81	29	27	10	7	----------	NP	A–2–4(0)	SM
----------	----------	100	99	98	47	38	54.6	29.8	A–7–6(19)	CH
----------	100	99	97	94	31	24	38.5	16.5	A–6–(11)	CL
----------	----------	100	99	96	33	26	38.0	15.4	A–6(10)	CL
39	30	22	11	9	2	2	----------	NP	A–1–2(0)	GP–GM
----------	100	99	86	84	69	59	66.5	42.3	A–7–6(20)	CH
----------	100	99	91	88	79	70	72.0	47.9	A–7–6(20)	CH
----------	100	99	89	88	70	50	51.8	31.2	A–7–6(18)	CH
----------	100	99	89	88	64	37	43.6	24.6	A–7–6(15)	CL

TABLE 12.—*Engineering*

Soil name and location	Parent material	Depth	Moisture-density [1]		Mechanical analysis [2]		
			Maximum dry density	Optimum moisture	Percentage less than 3 inches passing sieve—		
					1 in	¾ in	⅜ in
		In	*Lb per cu ft*	*Pct*			
Sisson loam: SW¼SW¼SW¼ sec. 23, T. 16 N., R. 13 E. (Modal profile)	Stratified loamy and sandy lacustrine material.	12–34					
		39–60	122.5	12.1			
Zittau silty clay loam: NE¼NE¼SW¼ sec. 3, T. 17 N., R. 13 E. (Modal profile)	Loamy and clayey deposits underlain by loamy fine sand and sand.	13–24					
		30–42					

[1] Based on AASHTO Designation T 99–57, Method A (*1*).

[2] Mechanical analysis according to the AASHTO Designation T 88–57 (*1*). Results by this procedure may differ somewhat from the results obtained by the Soil Survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by hydrometer method, and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculation of grain-size fractions. The mechanical analyses data in this table are not suitable for use in naming textural classes of soil.

rock is deeply mantled by glacial deposits in most places. Isolated escarpments of sandstone, generally on the lower positions below dolomite escarpments, are scattered throughout the county. Gotham, sandstone substratum, and Urne soils were derived from or are underlain by sandstone. Most of the acreage of these soils is in the southwestern part of the county.

Organic matter is the parent material for numerous soils in the county. It mainly consists of sedges, reeds, and grasses in various stages of decomposition. Adrian and Palms soils are representative of soils that formed in 16 to 50 inches of organic material overlying mineral soil material. Houghton soils formed in more than 50 inches of organic material. Edwards soils formed in 16 to 50 inches of organic material overlying marl.

An important fact about the soils in Green Lake County is that many of them formed in two or more parent materials. It is also important that the mode of origin of much of the sandy sediment in the western part of the county is difficult to determine. The Grellton soil formed in three parent materials; the upper part formed in a loamy mantle, the middle part in windblown silt, and the lower part in gravelly sandy loam glacial till.

Climate

Climate affects soil formation through the moisture and heat it contributes to an environment. It has a direct effect on the weathering of rocks and the alteration of parent material through the mechanical action of freezing and thawing and the chemical action generated by the leaching of water. Climate has an indirect effect through its influence on plant and animal life.

Differences in climate within the survey area are too small to have any great effect on differences in the soils. The area is within a climatic zone, however, where both prairie vegetation and woodland vegetation are competing for dominance in the soil-plant regime. Mendota and Plano soils are representative of soils that formed under grassland vegetation. They have a thick, dark-colored surface layer. Dodge, Kidder, and Lapeer soils formed under woodland vegetation and lack the thick, dark-colored surface layer.

Plant and animal life

Plants and animals in and on the soil provide organic matter and mix the soil material. They bring plant nutrients from the lower horizons to the upper horizons.

The influence of different kinds of vegetation on the formation of soils is shown by the differences in color between soils that formed under woods and those that formed under prairie grasses. Kidder soils formed under woods and have a lighter colored or thinner, dark-colored surface layer and are generally more acid than those formed under grass. Plano soils formed under grass and have a thick, dark-colored surface layer. Soil that formed under grass accumulate more organic matter and retain it longer than soils that formed under trees. The humus contributes to their darker color. Soils that formed in places where the vegetation is a mixture of trees and grasses generally have characteristics of both woodland and prairie soils.

Man's activities have been so important that he is often referred to as the sixth soil-forming factor. During the past 125 years, man has influenced the soils by disturbing and altering the natural soil-forming processes. He has greatly altered the original condition of many soils by clearing, burning, and cultivating.

test data—Continued

Mechanical analysis [2]—Continued							Liquid limit [3]	Plasticity index [4]	Classification	
Percentage less than 3 inches passing sieve—Continued				Percentage smaller than—					AASHTO [5]	Unified
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
							Pct			
----------	100	95	48	44	26	21	27.6	11.6	A–6–(3)	SC
----------	100	99	90	81	23	13	19.8	2.6	A–4–(8)	ML
----------	100	99	91	91	87	79	87.7	58.1	A–7–6(20)	CH
----------	100	95	15	14	12	11	----------	NP	A–2–4(0)	SM

[3] Based on AASHTO Designation T 89–60 (*1*).

[4] Based on AASHTO Designation T 90–56 and AASHTO Designation T 91–54 (*1*).

[5] Based on AASHTO Designation M 145–59 (*1*).

[6] NP means nonplastic.

Man has contributed to accelerated erosion by repeatedly removing plant cover from terraces and uplands. He has often contributed to loss of organic matter through overcultivation and has reduced the infiltration rate. He has changed the loose porous surface layer to clods through overcultivation and the use of heavy equipment.

Where good management and suitable crop rotations have been used, the soil has not been harmed and crop yields have gradually increased. Additions of animal manure and the growth of grasses such as bromegrass have increased the organic-matter content of the surface layer and upper part of the subsoil beyond the level in virgin woodland soils.

Man has altered the natural acidity of the soils by liming. The lime has not only improved plant growth but has created a more favorable environment for soil bacteria. The increased bacterial action, in turn, has hastened the decomposition of organic matter that darkens the cultivated part of many soils.

Man has also applied fertilizer to increase the supply of plant nutrients. He has grown alfalfa, which with its long taproot transfers calcium and other plant food elements from the lower part of the subsoil and the substratum to the surface layer.

Man has improved drainage by constructing waterways and building water control structures. Drainage of wetlands has permitted cultivation of many high-potential soils but has contributed to a general lowering of the water table throughout the area.

Evidence of man's activity can be seen in areas where the surface layer is now mostly brown subsoil. This soil loss is also apparent in the over-thickened surface layer on foot slopes and along natural drainageways, where sediments washed from the surrounding soils are 2 to 3 feet or more thick. Included in mapping the Joy, Ossian, and Plano soils were areas of soils that formed in sediments overlying older, buried soils.

Other changes caused by man's manipulation of the soil and landscape include the tendency towards more flash flooding where woodland cover is removed from the more sloping soils of the watershed; rapid filling of lakes and reservoirs with sediments; contamination of ground water with sewage effluent and fertilizer elements, especially nitrates; and the general effect of pesticides on soil organisms and ground water. All of man's activities affect the soil in some way, but some of the changes will not be evident for many years.

Relief

The hills, valleys, benches, and plains of Green Lake County are results of the work of rains, rivers, winds, glacial ice, and glacial meltwater over long periods of time. Where bedrock controls the topography, the resistance or lack of resistance of the underlying rocks has determined the relief. Relief, in turn, influences soil formation by controlling drainage, runoff, and other direct or indirect effects of water, including erosion. In many places the relief of a given soil can be correlated closely with the drainage; the thickness and organic-matter content of the A1 horizon; the depth of the solum; and the differentiation of horizons in the soil profile.

In Green Lake County the surface layer is generally light colored on more sloping soils and successively darker and thicker on the more gently sloping soils and in areas where the slope changes from convex to concave. Runoff is slower where the slopes are more gentle, and consequently more water soaks into the soil. As a result, plants grow better on the gentler slopes and more organic matter accumulates in the A1 horizon.

The relationship of relief to soil formation is shown by the general pattern of thin, steep soils and of progressively better developed, deeper soils that have gentler slopes. The deeper soils contain more clay in the subsoil than the thin, immature soils. Boyer and Rodman soils show the influence of relief on soil development. These soils formed in the same kind of parent material, but the generally more sloping Rodman soils lack the clay accumulation and well-defined structure in the B horizon that is characteristic of the deeper, more gently sloping Boyer soils.

Drainage characteristics are generally reflected in the color, degree, and kind of mottling or gleying in the soil profile. Well-drained Dodge, Griswold, and Kidder soils are mottle-free throughout the solum. Friesland, Grellton, and Plano soils are well drained and moderately well drained. Many of the nearly level and gently sloping soils of these series have mottles in the lower part of the B horizon.

Joy, Kibbie, and Manawa soils are representative of the somewhat poorly drained soils in the county. They are mottled throughout the B and C horizons. Barry, Colwood, Marshan, and Ossian soils are representative of the poorly drained soils in the county. They are generally mottled in the A horizon and gleyed in the B and C horizons.

Time

Time has had some effect on differences among the soils of the survey area. Soils of the alluvial plains, for example, do not have distinct horizons, because the soil material has not been in place long enough for the soil-forming processes to take full effect. Well-drained soils that formed in glacial till and in windblown silts, on the other hand, have well-defined horizons as the result of processes that have been active for thousands of years. In some soils, such as the Joy, Ossian, and Plano soils along natural drainageways, new material is added to the surface from time to time and covers an older soil. This material has not been in place long enough for distinct horizons to have formed.

Horizon Differentiation

A combination of basic processes is responsible for horizon differentiation. All soils have at least the potential for these processes. There are four main processes, *gains, losses, transfers,* and *transformations,* and they generally do not act alone. Some changes promote horizon differentiation and others retard or offset horizon differentiation. The balance among changes determines the nature of the soil at any given point.

An example of how these soil-forming processes interact can be seen in the Plano soils. The parent material of these soils was calcareous gravelly sandy loam till and windblown silt. The silt was probably deposited over the till during and after the glacial period. Because these soils are high on the landscape and are underlain by porous till, they are well drained and moderately well drained. The climate was favorable for the growth of plants. Plants and animals contributed to the accumulation of organic matter and organic acids, and they mixed the soil to some extent. These processes accelerated as more and higher forms of organisms grew in the soil and produced a greater volume of organic residue and acids.

Free lime in the soil material gradually dissolved and was moved downward by percolating waters into the lower part of the soil. As water continued to move downward through the soil, suspended particles of clay also were translocated. As a result, the Plano soil has more clay in the lower part of the silty layer and the upper part of the glacial till than in other parts. While clay was being moved downward in the soil, organic matter in various stages of decomposition was accumulating on or near the surface. The decomposed organic matter gave the surface layer a darker color than it originally had.

While these changes were occurring in the silty part of the soil, the loamy lower part was forming in till of mixed minerology that contained a significant amount of dolomite fragments. Chemical weathering of the dolomite and other weatherable minerals gradually changed this layer to a mixture of gravel and heavy sandy loam. Oxidized iron, which occurs as impurities in the dolomite, gives this layer a darker color than the underlying unweathered till.

As a result of these soil-forming processes, the Plano soils now have a surface layer of silt loam and a subsoil that is silty clay loam in the upper part and is dark-brown heavy sandy loam in the lower part. These soils are underlain at a depth of about 58 inches by unweathered, moderately alkaline till that has changed little since it was deposited by the glacier.

Processes that took place in the formation of Plano soils were *gains* of organic matter in the surface layer, *loss* of clay from the upper part of the soil and subsequent *transfer* to the lower part of the profile, and *transformation* of iron compounds in the lower part of the subsoil.

All these processes are active in all soils of the survey area. In Green Lake County, the kinds of parent material and relief have, to a great extent, determined the kinds of processes that are dominant in the formation of all the soils, and they have caused differences among the soils.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study,

readers interested in developments of the current system should search the latest literature available (*20, 22*).

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. The same property or subdivisions of this property may be used in several different categories. In table 13, the soil series of Green Lake County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. Three exceptions to this are the Entisols, Histosols, and Vertisols which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Moll-i-sol).

SUBORDER. Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of a water table at a shallow depth, soil climate, the accumulation of clay, iron, or organic carbon in the upper solum, cracking of soils caused by a decrease in soil moisture, and fine stratification. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquoll* (*Aqu*, meaning water or wet, and *oll*, from Mollisol).

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of soil horizons and features. The horizons used to make separations are those in which clay, carbonates, and other constituents have accumulated or have been removed; and those that have pans that interfere with growth of roots, movement of water, or both. Some features used are soil acidity, soil climate, soil composition, and soil color. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquoll (*Hapl*, meaning simple horizons, *aqu* for wetness or water, and *oll*, from Mollisols).

SUBGROUP. Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Other subgroups may have soil properties unlike those of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplaquolls (a typical Haplaquoll).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, soil depth, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 13). An example is the coarse-loamy, mixed, mesic family of Typic Haplaquolls.

Environmental Factors Affecting Soil Use

This section gives information about the main features that affect the use and management of the soils of Green Lake County. It briefly explains those features that affect the existing and potential use of soils for farming and other purposes, such as the geology and underlying material and the climate of the county. There is also a brief discussion of trends in soil use.

Relief and Drainage

Green Lake County is about 75 percent uplands, 18 percent wetlands, and 7 percent water. Green Lake, Lake Puckaway, Grand River Marsh, and Fox River make up about 95 percent of the surface water acreage. The high plain or plateau in the southeastern part of the county has an average elevation of about 1,000 feet above sea level and is an area of mostly nearly level and gently sloping, well-drained soils. The northwestern part of the county has an average elevation ranging from 760 to 800 feet and is an area of mostly nearly level and gently sloping sandy soils and marsh. The rest of the county consists of knolls and valleys that have an average elevation of 800 to about 900 feet. This section of the county has a complex pattern of soil drainage and ranges from very poorly drained to excessively drained.

Geology and Underlying Material

The high plain or plateau in the southeastern part of the county is underlain by dolomite and sandstone. Dolomite is the upper bedrock layer and is within a few feet of the surface in many places.

There are a number of small quarries of dolomite. The smaller, earlier quarries were for building materials and possibly for agricultural lime. One large quarry in Mackford Township is used as a source of crushed dolomite for highway construction.

Natural crevices and fissures in the dolomite are the result of physical stress and chemical weathering. The crevices cause problems in certain uses of the soils underlain by dolomite. An example is the danger of ground water pollution when unfiltered septic tank effluent moves down these crevices. The use of soils underlain by dolomite for absorption filter fields is severely limited.

There is also a danger of ground water contamination through sinkholes in the underlying dolomite. These sinkholes are scattered throughout the southeastern part of the county and are often associated with Plano soils. Plano soils formed in windblown silts and glacial till, but in some areas of Green Lake County they are

TABLE 13.—*Classification of soil series*

Series	Family	Subgroup	Order
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic	Terric Medisaprists	Histosols.
Barry	Fine-loamy, mixed, mesic	Typic Argiaquolls	Mollisols.
Boyer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Brems	Mixed, mesic	Aquic Udipsamments	Entisols.
Briggsville	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
Colwood	Fine-loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Dodge	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Edwards	Marly, euic, mesic	Limnic Medisaprists	Histosols.
Friesland	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Gotham	Sandy, mixed, mesic	Psammentic Hapludalfs	Alfisols.
Granby	Sandy, mixed, mesic	Typic Haplaquolls	Mollisols.
Granby, clayey subsoil variant	Sandy over clayey, mixed, mesic	Typic Haplaquolls	Mollisols.
Granby, loamy subsoil variant	Sandy over loamy, mixed, mesic	Typic Haplaquolls	Mollisols.
Grellton	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Griswold	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Houghton	Euic, mesic	Typic Medisaprists	Histosols.
Joy	Fine-silty, mixed, mesic	Aquic Hapludolls	Mollisols.
Kibbie	Fine-loamy, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Kidder	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Knowles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Lapeer	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
LeRoy	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Lomira	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Manawa	Fine, mixed, mesic	Aquollic Hapludalfs	Alfisols.
Marcellon [1]	Fine-loamy, mixed, mesic	Aquic Argiudolls	Mollisols.
Markesan	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Haplaquolls	Mollisols.
Mecan	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Mendota	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Oakville	Mixed, mesic	Typic Udipsamments	Entisols.
Okee	Loamy, mixed, mesic	Arenic Hapludalfs	Alfisols.
Oshtemo	Coarse-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Ossian	Fine-silty, mixed, mesic	Typic Haplaquolls	Mollisols.
Palms	Loamy, euic, mesic	Terric Medisaprists	Histisols.
Plano	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Poy	Fine over sandy or sandy-skeletal, mixed, mesic	Typic Haplaquolls	Mollisols.
Poygan [2]	Fine, mixed, mesic	Typic Haplaquolls	Mollisols.
Richford	Sandy, mixed, mesic	Arenic Hapludalfs	Alfisols.
Ripon	Fine-silty, mixed, mesic	Typic Argiudolls	Mollisols.
Ritchey	Loamy, mixed, mesic	Lithic Hapludalfs	Alfisols.
Rodman	Sandy-skeletal, mixed, mesic	Typic Hapludolls	Mollisols.
Rotamer	Fine-loamy, mixed, mesic	Typic Argiudolls	Mollisols.
St. Charles	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Sisson	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Tustin	Clayey, mixed, mesic	Arenic Hapludalfs	Alfisols.
Urne [3]	Coarse-loamy, mixed, mesic	Dystric Eutrochrepts	Inceptisols.
Willette	Clayey, illitic, euic, mesic	Terric Medisaprists	Histisols.
Zittau	Clayey over sandy or sandy-skeletal, mixed, mesic	Aquollic Hapludalfs	Alfisols.

[1] Taxadjunct to the series. These soils have a slightly thinner dark-colored surface layer than is defined as the range of the series.
[2] Taxadjunct to the series. These soils have a thicker dark-colored surface layer than is defined as the range of the series.
[3] Taxadjunct to the series. These soils are more acid in the subsoil and more alkaline in the substratum than is defined as the range of the series.

underlain by dolomite at relatively shallow depths. Soil material has settled into many of the large crevices in the dolomite. Many of these sinkholes have been filled with stones or refuse in recent years (fig. 18).

The rate of water movement through these sinkholes varies from year to year. Because the surrounding soils are cultivated, a large amount of soil material washes into these sinkholes and plugs many of them. This plugging may last only until soil material further in the sinkholes is dislodged and falls into the deeper reaches of the cavern.

A landowner in Mackford Township observed in spring 1971 that melt water from the winter snow formed a whirling vortex as it entered a sinkhole north of Lake Emily. Other sinkholes nearby, which had drained quite rapidly in former years, were holding water because they were plugged by erosional sediments from nearby soils.

Sandstone underlies the dolomite. Although it is not exposed in many places, it has influenced many of the soils and landforms in the county. In most places where the protective dolomite cap has been removed by erosion, the sandstone has also been removed. Scattered throughout the county are a few exposures of sandstone which are generally on the lower slopes below outcrops of dolomite. In many places where the dolomite outcrops, the underlying sandstone is not visible because it is mantled by soil material eroded from the higher

Figure 18.—**Sinkhole in an area of Plano soils. Ground water may become polluted if manure or pesticides are spread near sinkholes. Sinkholes often lead to underground crevices or caverns in the underlying dolomite.**

slopes. In the areas underlain by dolomite, many deep valleys have been formed by geological erosion of the relatively soft sandstone.

Big Green Lake, the deepest lake in Wisconsin, has a sandstone bottom. It was once connected to Lake Puckaway, now a shallow lake with nearly 300 feet of recent sediments over sandstone, and formed a major drainageway for melt water during glacial times. A glacial dam of water-sorted sand and gravel now separates the two lakes.

Much of the loose sand which mantles the western parts of the county probably came from sandstone weathered and disintegrated by the glacier. This sand was later moved by glacial melt water and by the wind. The sand moved by glacial melt water left thick deposits of valley fill. Sand was blown onto the uplands and now mantles the older soils that formed in other materials, mostly glacial till. The mantle of windblown sand is generally thickest in the western part of the county and is thin or lacking in the eastern part. Some sand dunes extend into the eastern part of the county, which indicates that the wind direction was generally from the west or northwest. In some areas of Manchester Township the sand mantle is in strips that have a general north-south orientation, which indicates that the wind direction was northerly during the time of sand deposition. Where the sand mantle is thin over the older soils, or is in strips, there is a complex pattern of contrasting surface textures.

The sandstone in Green Lake County is dominantly silica sand, but has glauconitic sand strata in the upper part. Urne soils formed in glauconitic sand high in potassium. Potassium is a plant nutrient which sandy soils usually lack. There are two large sandstone quarries in Green Lake County where the sandstone is blasted, ground, and dried for commercial use (fig. 19).

The four outcroppings of igneous bedrock are in Berlin, Mackford, Marquette, and Seneca Townships. All of the outcrops were once quarried, but the Berlin quarry is the only one still operating. Much of the igneous bedrock has been used for gravestones and some for building material.

The dredged channel in Lake Puckaway was probably made to transport the granite quarried on the south side of the lake during the post-Civil War era. An old road crossing a large marsh from the igneous outcrop in Seneca Township is reported to have been built to transport quarried rock. This road now appears

Figure 19.—**Sandstone quarry in Green Lake Township. This high-quality silica sand is used in glass and for foundry sand.**

as a faint line on the aerial photograph. Originally the road was paved with logs to support the heavy loads of granite on the soft organic soil (fig. 20).

Most of the southern and eastern parts of the county are underlain by gravelly sandy loam glacial till which contains a few pits. The material is generally used for road construction and fill. The till is a relatively good filtering media and has only slight limitations for many soil uses. Kidder, Lapeer, Mecan, and Rotamer soils formed in glacial till in the more rolling parts of the county. These soils generally contain a significant amount of coarse fragments. Most of the fragments are partly rounded igneous rock, and some of the larger boulders are more than 4 feet in diameter. Because many areas of glacial till soil are wet or are not cleared of trees or have boulders on the surface, they are not cleared for cultivation.

Stone fences and barn foundations made from field stones are commonly near soils that formed in glacial till. Many stone fences are 6 to 10 feet wide and several feet high. The stones were taken from nearby fields over a period of many years. Some additional stones are exposed each year as a result of frost heaving, erosion, and soil blowing.

Many of the landforms, especially drumlins, in the more rolling parts of the county underlain by glacial till have long, uniform slopes. The drumlins have a general east-west orientation and are as much as 1 mile long. These landforms are suited to erosion control practices such as stripcropping, terraces, and diversions.

Glacial outwash is stratified sand and gravel which was deposited by glacial melt water. These materials are desirable for road building and for making concrete. Several areas of these deposits are scattered throughout Green Lake County, the most extensive along the Grand River near Manchester and at the west end of Green Lake. These deposits are valley-fill materials between hills of glacial till. Scattered, thin remnants of outwash mantle the lower slopes of many hills which border the larger glacial drainageways.

There are large pits in the outwash deposits near Manchester and at the west end of Green Lake. The extensive deposits between Green Lake and Lake Puckaway block what was a major drainageway during glacial times. Much of this area has hills and depressions which are the result of large blocks of ice melting in the outwash deposits. The badly pitted areas are generally not suited to extensive cultivation because slopes are steep and irregular and the soil is commonly thin over sand and gravel. Many of these areas were never cleared

Figure 20.—**An outcrop of igneous rock, sometimes called "black granite." In the past it has been used for cemetery headstones.**

of trees. The outwash deposits in Green Lake County are mostly sandy and contain only small amounts of gravel. These deposits have less value for most uses than the more gravelly deposits.

Climate [5]

The climate of Green Lake County is continental, typical of the center of a continent in the middle latitudes. Winters are long, cold, and snowy; summers are warm and occasionally humid. At times spring and fall are short and mixtures of warm and cold weather. Spring often lingers into June, but the change from summer to fall is usually abrupt. The seasons vary widely from year to year. All seasons are marked by storms that accompany changes from one air mass to another, particularly during the period from late fall through mid-spring when changes occur every two to four days.

Data in tables 14 and 15 are fairly representative of the climate of the county. Most of these data were obtained from the weather station at Dalton in the southwestern corner of the county. The range in daily and annual temperatures tends to be less at higher elevations and greater at lower elevations and in large expanses of marshland. Minimum temperatures are lowered by the drainage and accumulation of cold air in these places.

The temperature and precipitation for Green Lake County are given in table 14. Temperatures of 90° or higher have occurred on an average of 14 days a year, but the number of days has varied from 32 in 1948 to 0 in 1951. Temperatures of zero or lower occur on an average of 24 days a year, but the number of days has varied from 51 in 1963 to 12 in 1946.

Precipitation is usually well distributed for farming purposes. Approximately 60 percent of the yearly normal falls in the 5-month period of May through September. In summer the probability of 1 inch or more of rain falling in a 7-day period is greatest during the first half of June (the chance is that it will occur in more than 4 years out of 10). The probability of a dry 7-day period, when precipitation is a trace or less, in summer is greatest during the last part of July (it will probably occur in 2 to 3 years out of 10). Intensities of about 1.25 inches of rainfall in 1 hour, 2.00 inches in 6 hours, and 2.80 inches in 24 hours can be expected about once in 2 years.

[5] By HANS E. ROSENDAL, climatologist for Wisconsin, National Weather Service, U.S. Department of Commerce.

TABLE 14.—*Temperature and precipitation data*

[Data from records at Dalton Weather Station]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average monthly highest maximum	Average monthly lowest minimum	Average	One year in 10 will have—		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
						Less than—	More than—		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	28	8	43	−18	1.2	0.4	2.0	24	6.0
February	31	11	45	−12	1.1	.3	2.1	19	7.6
March	41	21	63	− 2	1.6	.8	2.9	13	6.5
April	58	34	76	20	2.9	1.3	4.1	3	2.1
May	69	44	85	28	3.4	1.6	5.7	[1]	[1]
June	79	54	90	38	4.3	2.3	6.4	0	0
July	83	59	91	44	3.2	1.8	4.9	0	0
August	82	58	91	42	3.4	1.9	5.4	0	0
September	74	49	87	31	3.3	1.3	6.9	0	0
October	64	40	79	22	2.0	.6	4.3	[1]	[1]
November	44	26	63	7	2.3	.8	3.9	3	2.8
December	31	14	51	−10	1.3	.5	2.0	15	3.9
Year	57	35	[3] 93	[4] −19	30.0	21.0	39.0	77	5.8

[1] Less than one-half day.

[2] Trace.

[3] Average annual highest temperature.

[4] Average annual lowest temperature.

The amount of snowfall in a year has varied from 89 inches in 1959 to 12 inches in 1958 and 1953. The average date of the first snowfall of 1 inch or more is November 23. The chance that this snow will fall by October 26 is 1 in 10 years, and by December 21 is 9 in 10 years.

Thunderstorms occur on an average of 41 days a year, and in individual years range from 53 to 28 days. Hail occurs on an average of 2 days a year, and in extreme years on 6 to 0 days.

Wind, sunshine, and relative humidity records are not available, but the following data from records kept at Madison in Dane County should approximate conditions in Green Lake County.

Prevailing winds are westerly in winter and southerly in summer. March, April, and November are the windiest months and have average windspeeds of 12 miles per hour. The windspeed averages less than 4 miles an hour about 10 percent of the time, 4 to 12 miles about 50 percent, 13 to 31 miles about 40 percent, and more than 31 miles per hour less than 1 percent. Winds that have the highest speeds are usually from the west or southwest.

Sunshine averaged about 40 percent of the amount possible for November and December, 60 percent or more for May through October, and between 50 and 60 percent for the remaining months.

A relative humidity of less than 50 percent was recorded at the Madison Weather Station 5 percent of the time in winter, 20 percent in spring, 15 percent in summer, and 20 percent in fall. Humidity of 50 to 79 percent was recorded 55 percent of the time in winter, 50 percent in spring, 45 percent in summer, and 50 percent in fall. Humidity of more than 79 percent was recorded 40 percent of the time in winter, 30 percent in spring, 40 percent in summer, and 30 percent in fall.

Table 15 gives the probabilities of last freezing temperatures in spring and first in fall. The average date of the last 32-degree freeze in the spring is May 13 and the first in the fall is September 26. The growing season, defined as the number of days between the last 32-degree freeze in spring and the first in fall, averages 136 days.

The freeze data are calculated for Dalton, and minimum temperatures vary considerably across Green Lake County on calm, clear nights. They depend on such physical characteristics as the topography and soil types of the area and the proximity to open water.

Water Supply

Most of Green Lake County is in the southern part of the Fox-Wolf River Basin. This basin includes all or significant parts of 18 counties in east-central and northeastern Wisconsin (*15*). Ground water generally moves southeastward into Green Lake County. This water movement is caused by the slope of the underlying crystalline rock surface, which generally dips southeastward at about 15 to 20 feet per mile. The crystalline rock controls the dip of the sedimentary rock formations that overly it.

The sandstones of Cambrian age, the Prairie du Chien Group, and the St. Peter Sandstone form the principal bedrock aquifer in the basin. Properly constructed wells commonly yield 500 to 1,000 gallons of water per minute in parts of Green Lake County. As the aquifer thins towards the northwest, well yields diminish to 100 to 500 gallons per minute. Where the aquifer is very thin, as in the preglacial river valley

TABLE 15.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from records at Dalton Weather Station]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	April 14	April 24	May 4	May 16	May 29
2 years in 10 later than	April 8	April 18	April 28	May 10	May 24
5 years in 10 later than	March 28	April 7	April 17	April 30	May 13
Fall:					
1 year in 10 earlier than	October 24	October 17	October 3	September 18	September 10
2 years in 10 earlier than	October 30	October 22	October 9	September 25	September 15
5 years in 10 earlier than	November 10	November 2	October 20	October 5	September 26

in the northwestern part of the county, well yields are 10 to 100 gallons a minute. The crystalline rock generally does not yield water to wells.

The Platteville-Galena aquifer generally yields less than 50 gallons per minute to wells, but it is important for domestic and farm wells. This unit tends to prevent vertical movement of water, causing artesian pressures in the underlying sandstone aquifer.

Glacial deposits which overlie the bedrock are also aquifers. Availability of water from these deposits varies widely within small areas. The best glacial drift aquifers are thick sand and gravel outwash deposits.

The clay and silt deposited in glacial lakes restrict water movement and are not good aquifers. In much of Green Lake County, glacial drift deposits are thin and are slowly permeable. Wells yield only about 5 to 10 gallons per minute. Water in these areas is generally obtained from wells that penetrate bedrock aquifers.

In the preglacial river valley in the northwestern part of the county and in the smaller branch that is the present Green Lake-Lake Puckaway Basin, the glacial deposits are 200 to 300 feet thick. Wells yield 10 to 100 gallons per minute.

In Green Lake County glacial drift aquifers are the main source of ground water discharge to streams. The aquifers are recharged by rainfall that averages approximately 30 inches per year. Seasonal and long-term climatic variations cause fluctuations in both streamflow and ground water levels.

Green Lake County has approximately 15,000 acres of lakes and rivers and about 44,000 acres of wetlands. There are numerous small springs, especially along the bedrock escarpments and in the clayey lake basins in the north-central part of the county.

Natural Vegetation

Green Lake County originally was not extensively forested. The first economic development of the county was farming. Today approximately 12 percent of the land area is woodland. Most of the more rolling parts of the county were forested with oak, hickory, and maple.

The southeastern part of the county is a high plain or plateau that covers nearly 30 percent of the county. This area was a grassland prairie when the first settlers arrived.

Approximately 19.6 percent of the land area was originally wetlands that were too wet for most trees and grasses. These wetlands supported a growth of marsh grasses, shrubs, and trees such as bur oak, soft maple, elm, and tamarack.

Transportation and Schools

Green Lake County is served by two railroads. One goes near the city of Green Lake and through Princeton, and a branch line goes through Dalton in the southwestern part of the county. The other goes through Berlin, and a branch line serves Markesan.

Green Lake County is traversed by five 2-lane State highways. The county highways are almost entirely hard-surfaced, and only a few roads are gravel. Many of the county highways in the more densely populated areas are on section lines that take in a square mile.

Green Lake County has no commercial airports. Scheduled flights are available at the Oshkosh airport, however, which is about 25 miles away.

There are four high schools in Green Lake County at Berlin, Green Lake, Princeton, and Markesan as well as numerous public and parochial elementary schools. Although there are no colleges in Green Lake County, there are several located nearby.

Industry

The production of apparel and leather goods, foundry and food products are major industries in Green Lake County. Berlin is the major industrial center, producing mainly leather goods and gray iron castings. The growth and processing of vegetable crops, such as sweet corn, peas, and snap beans, are also important in season. The industrial base of Green Lake County has grown significantly in the past decade. Because of the county's proximity to the Fox River Valley industrial district and the lakeshore complex, there will probably be further industrial growth (*24*).

Green Lake County is mainly agricultural. There

are businesses that service and sell machinery and other farm supplies in Berlin, Markesan, Montello, Princeton, and Ripon. There are also several livestock markets in the Green Lake County area which buy and sell cattle, calves, hogs, and feeder pigs.

Trends in Soil Use

The number of farms in the county is decreasing, and the average size per farm is increasing. In 1964, there were 961 farms in Green Lake County with an average size of 182.8 acres. In 1969, there were 877 farms with an average size of 193.1 acres (*24*).

Many areas of sandy soil and soils that have a low available water capacity have been retired from farming and planted to pine trees. An increasing amount of land is being used for nonagricultural uses, such as rural nonfarm homes, summer cottages, camping, and recreational areas. The county's attractive lakes, streams, and wetlands and its accessibility to residents of the Fox River Valley, southeastern Wisconsin, and northern Illinois make it a favorable rural retreat for urban residents. Areas near the many lakes and streams are becoming increasingly important as homesites and recreational areas. Wooded tracts throughout the county are also in demand for these uses (*7*).

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The classes used in Green Lake County and the inches of available water in the soil to a depth of 60 inches or to a limiting layer such as bedrock are as follows: very low, 0 to 3 inches; low, 3 to 6 inches; moderate, 6 to 9 inches; high, 9 to 12 inches; very high, over 12 inches.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Organic matter. Plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition. Classes and percentages of organic matter in Green Lake County soils are as follows:

Class	*Percent*	*Class*	*Percent*
Low	0.5 to 1	Moderate	2 to 4
Moderately low	1.0 to 2	Moderate to high	3 to 5
Moderate to moderately low	1.5 to 2.5	Very high	8 to 13
		Organic soil	>20.68

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains

consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil slope. The difference in elevation in feet between two points 100 feet apart, given in percent. The slope symbol, percent of slope, and slope class of the soils in Green Lake County are as follows: A, 0 to 2 percent, nearly level; B, 2 to 6 percent (0 to 6 percent for sandy soils), gently sloping; C, 6 to 12 percent, sloping; D, 12 to 20 percent, moderately steep; and E, 20 to 30 percent, steep. In some of the moderately steep and steep soils, the slope groups are slightly different than listed here. Soils that have no slope symbol are considered nearly level.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis ,at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit, a woodland suitability group or any other group, read the introduction to the section it is in for general information about its management.

Map symbol	Mapping unit	Page	Capability unit		Woodland group	Tree and shrub group	Wildlife group	Recreation group
			Symbol	Page				
Ad	Adrian muck	9	IVw-7	66	3w3	4	8	8
An	Alluvial land, wet	11	Vw-14	66	4w2	3	7	7
Bb	Barry loam	11	IIw-1	62	4w2	3	7	7
BpB	Boyer loamy fine sand, 1 to 6 percent slopes	12	IIIs-4	65	3o1	2	1	2
BpC2	Boyer loamy fine sand, 6 to 12 percent slopes, eroded	13	IIIe-7	64	3o1	2	1	2
BpD	Boyer loamy fine sand, 12 to 25 percent slopes	13	IVe-7	65	3r1	2	1	2
BrB	Brems loamy fine sand, 0 to 6 percent slopes	14	IVs-3	66	3s1	2	3	2
BsA	Briggsville silt loam, 0 to 2 percent slopes	14	IIe-6	62	2c1	1	2	3
BsB	Briggsville silt loam, 2 to 6 percent slopes	15	IIe-6	62	2c1	1	2	3
Co	Colwood silt loam	15	IIw-1	62	1w1	3	7	7
DdB	Dodge silt loam, 2 to 6 percent slopes	16	IIe-1	61	2o1	1	1	1
DdC2	Dodge silt loam, 6 to 12 percent slopes, eroded	16	IIIe-1	63	2o1	1	1	1
Ed	Edwards muck	17	IVw-7	66	3w3	4	8	8
FoA	Friesland loam, 0 to 2 percent slopes	18	I-4	61	---	1	5	1
FoB	Friesland loam, 2 to 6 percent slopes	18	IIe-1	61	---	1	5	1
GaB	Gotham loamy fine sand, 1 to 6 percent slopes	18	IVs-3	66	3s1	2	3	2
GaC	Gotham loamy fine sand, 6 to 12 percent slopes	19	IVs-3	66	3s1	2	3	2
GbC	Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes	19	IVs-3	66	3s1	2	3	4
GbD	Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes	19	VIe-7	68	3s3	2	3	4
Gf	Granby loamy fine sand	20	IVw-5	66	3w1	3	7	7
GhA	Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes	21	IIIw-6	64	3w1	3	7	7
GkA	Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes	21	IIIw-6	64	3w1	3	7	7
GnA	Grellton fine sandy loam, 0 to 2 percent slopes	22	I-4	61	1o1	1	1	1
GnB	Grellton fine sandy loam, 2 to 6 percent slopes	22	IIe-1	61	1o1	1	1	1
GnC2	Grellton fine sandy loam, 6 to 12 percent slopes, eroded	22	IIIe-1	63	1o1	1	1	1
GnD2	Grellton fine sandy loam, 12 to 20 percent slopes, eroded	23	IVe-1	65	1r1	1	1	1
GrA	Griswold silt loam, 0 to 2 percent slopes	23	I-4	61	---	1	5	1
GrB	Griswold silt loam, 2 to 6 percent slopes	24	IIe-1	61	---	1	5	1
GrC2	Griswold silt loam, 6 to 12 percent slopes, eroded	24	IIIe-1	63	---	1	5	1
Ho	Houghton muck	24	IIIw-9	64	3w3	4	8	8
JoA	Joy silt loam, 0 to 3 percent slopes	25	IIw-2	62	4o1	3	6	6
KbA	Kibbie loam, 0 to 3 percent slopes	26	IIw-2	62	1o2	3	6	6
KdA	Kidder fine sandy loam, 0 to 2 percent slopes	27	I-4	61	2o1	1	1	1
KdB	Kidder fine sandy loam, 2 to 6 percent slopes	27	IIe-1	61	2o1	1	1	1
KdC2	Kidder fine sandy loam, 6 to 12 percent slopes, eroded	27	IIIe-1	63	2o1	1	1	1
KdD2	Kidder fine sandy loam, 12 to 20 percent slopes, eroded	27	IVe-1	65	2r1	1	1	1
KeA	Kidder loam, 0 to 2 percent slopes	28	I-4	61	2o1	1	1	1
KeB	Kidder loam, 2 to 6 percent slopes	28	IIe-1	61	2o1	1	1	1
KeC2	Kidder loam, 6 to 12 percent slopes, eroded	28	IIIe-1	63	2o1	1	1	1
KeD2	Kidder loam, 12 to 20 percent slopes, eroded	28	IVe-1	65	2r1	1	1	1
KeE	Kidder loam, 20 to 30 percent slopes	28	VIe-1	67	2r1	1	1	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland group	Tree and shrub group	Wildlife group	Recreation group
			Symbol	Page				
KwA	Knowles silt loam, 0 to 2 percent slopes	29	IIe-2	62	2o1	1	1	4
KwB	Knowles silt loam, 2 to 6 percent slopes	29	IIe-2	62	2o1	1	1	4
KwC2	Knowles silt loam, 6 to 12 percent slopes, eroded	30	IIIe-2	63	2o1	1	1	4
KwD2	Knowles silt loam, 12 to 20 percent slopes, eroded	30	IVe-2	65	2r1	1	1	4
LaB	Lapeer loamy fine sand, 2 to 6 percent slopes	30	IIIe-4	63	3o1	1	1	2
LaC2	Lapeer loamy fine sand, 6 to 12 percent slopes, eroded	31	IVe-4	65	3o1	1	1	2
LaD2	Lapeer loamy fine sand, 12 to 25 percent slopes, eroded	31	VIe-4	67	3r1	1	1	2
Lb	Lapeer fine sandy loam, 0 to 2 percent slopes	31	IIIs-4	65	3o1	1	1	2
LrC2	LeRoy silt loam, 6 to 12 percent slopes, eroded	32	IIIe-1	63	2o1	1	1	1
LrD2	LeRoy silt loam, 12 to 20 percent slopes, eroded	32	IVe-1	65	2r1	1	1	1
LvB	Lomira silt loam, 2 to 6 percent slopes	33	IIe-1	61	2o1	1	1	1
LvC2	Lomira silt loam, 6 to 12 percent slopes, eroded	33	IIIe-1	63	2o1	1	1	1
LvD2	Lomira silt loam, 12 to 20 percent slopes, eroded	33	IVe-1	65	2r1	1	1	1
MaA	Manawa silt loam, 0 to 3 percent slopes	34	IIw-2	62	2c2	3	6	6
McA	Marcellon loam, 0 to 3 percent slopes	34	IIw-2	62	2o1	3	6	6
MdB2	Markesan silt loam, 2 to 6 percent slopes, eroded	35	IIe-1	61	---	1	5	1
MdC2	Markesan silt loam, 6 to 12 percent slopes, eroded	36	IIIe-1	63	---	1	5	1
MdD2	Markesan silt loam, 12 to 20 percent slopes, eroded	36	IVe-1	65	---	1	5	1
Mf	Marsh	36	VIIIw-15	68	6w1	---	7	8
Mh	Marshan silt loam	37	IIw-5	62	4w2	3	7	7
MnB	Mecan loamy fine sand, 2 to 6 percent slopes	38	IIIe-4	63	3o1	1	1	2
MnC2	Mecan loamy fine sand, 6 to 12 percent slopes, eroded	38	IVe-4	65	3o1	1	1	2
MsA	Mendota silt loam, 0 to 2 percent slopes	39	I-4	61	---	1	5	1
MsB	Mendota silt loam, 2 to 6 percent slopes	39	IIe-1	61	---	1	5	1
MsC2	Mendota silt loam, 6 to 12 percent slopes, eroded	39	IIIe-1	63	---	1	5	1
OaB	Oakville fine sand, 1 to 6 percent slopes	40	IVs-3	66	3s1	2	3	2
OaC	Oakville fine sand, 6 to 12 percent slopes	40	VIs-3	68	3s1	2	3	2
OaD	Oakville fine sand, 12 to 35 percent slopes	41	VIIs-3	68	3s3	2	3	2
OkB	Okee loamy fine sand, 1 to 6 percent slopes	42	IIIs-4	65	2s1	1	1	2
OkC	Okee loamy fine sand, 6 to 15 percent slopes	42	IIIe-7	64	2s1	1	1	2
OmB	Oshtemo loamy fine sand, 1 to 6 percent slopes	43	IIIs-4	65	3o1	2	1	2
OmC2	Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded	43	IIIe-7	64	3o1	2	1	2
Os	Ossian silt loam	44	IIw-1	62	3w2	3	7	7
Pa	Palms muck	44	IIw-8	63	3w3	4	8	8
PnA	Plano silt loam, 0 to 2 percent slopes	45	I-4	61	---	1	5	1
PnB	Plano silt loam, 2 to 6 percent slopes	45	IIe-1	61	---	1	5	1
Pr	Poy silty clay loam	46	IIw-5	62	2w1	3	7	7
Py	Poygan silty clay loam	47	IIw-1	62	2w1	3	7	7
RaB	Richford loamy sand, 1 to 6 percent slopes	47	IIIs-4	65	3o1	2	3	2
RaC	Richford loamy sand, 6 to 15 percent slopes	48	IIIe-7	64	3o1	2	3	2
ReB	Ripon silt loam, 1 to 6 percent slopes	48	IIe-2	62	---	1	5	4
RhB2	Ritchey silt loam, 2 to 6 percent slopes, eroded	49	IIIe-3	63	3d1	2	4	5
RhC2	Ritchey silt loam, 6 to 12 percent slopes, eroded	49	IVe-3	65	3d1	2	4	5
RhD2	Ritchey silt loam, 12 to 20 percent slopes, eroded	50	VIe-3	67	3d2	2	4	5

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Woodland group	Tree and shrub group	Wildlife group	Recreation group
			Symbol	Page				
RkE	Rock land and Ritchy soil, 6 to 45 percent slopes	50	VIIIs-10	69	6s1	---	10	5
Ro	Rock outcrop	51	VIIIs-10	69	6s1	---	10	5
RsD	Rodman gravelly sandy loam, 6 to 20 percent slopes	51	VIs-5	68	4f2	2	4	2
RsE	Rodman gravelly sandy loam, 20 to 35 percent slopes	51	VIIs-5	68	4f2	2	4	2
RtB2	Rotamer sandy loam, 2 to 6 percent slopes, eroded	52	IIe-1	61	---	1	5	1
RtC2	Rotamer sandy loam, 6 to 12 percent slopes, eroded	53	IIIe-1	63	---	1	5	1
RtD2	Rotamer sandy loam, 12 to 20 percent slopes, eroded	53	IVe-1	65	---	1	5	1
RtE	Rotamer sandy loam, 20 to 30 percent slopes	53	VIe-1	67	---	1	5	1
ScA	St. Charles silt loam, 0 to 2 percent slopes	54	I-4	61	1o1	1	1	1
ScB	St. Charles silt loam, 2 to 6 percent slopes	54	IIe-1	61	1o1	1	1	1
ScC2	St. Charles silt loam, 6 to 12 percent slopes, eroded	54	IIIe-1	63	1o1	1	1	1
SnB	Sisson loam, 2 to 6 percent slopes	55	IIe-1	61	1o1	1	1	1
SnC2	Sisson loam, 6 to 12 percent slopes, eroded	55	IIIe-1	63	1o1	1	1	1
SnD2	Sisson loam, 12 to 20 percent slopes, eroded	55	IVe-1	65	1r1	1	1	1
TuB	Tustin loamy fine sand, 1 to 6 percent slopes	56	IIIe-4	63	3o1	2	2	3
UrB	Urne loamy fine sand, 2 to 6 percent slopes	57	IIIs-4	65	3o1	2	3	4
UrC2	Urne loamy fine sand, 6 to 12 percent slopes, eroded	57	IIIe-7	64	3o1	2	3	4
UrD2	Urne loamy fine sand, 12 to 30 percent slopes, eroded	57	IVe-7	65	3r1	2	3	4
We	Willette muck	58	IIIw-8	64	3w3	4	8	8
ZtA	Zittau silty clay loam, 0 to 3 percent slopes	59	IIw-5	62	3c2	3	6	6

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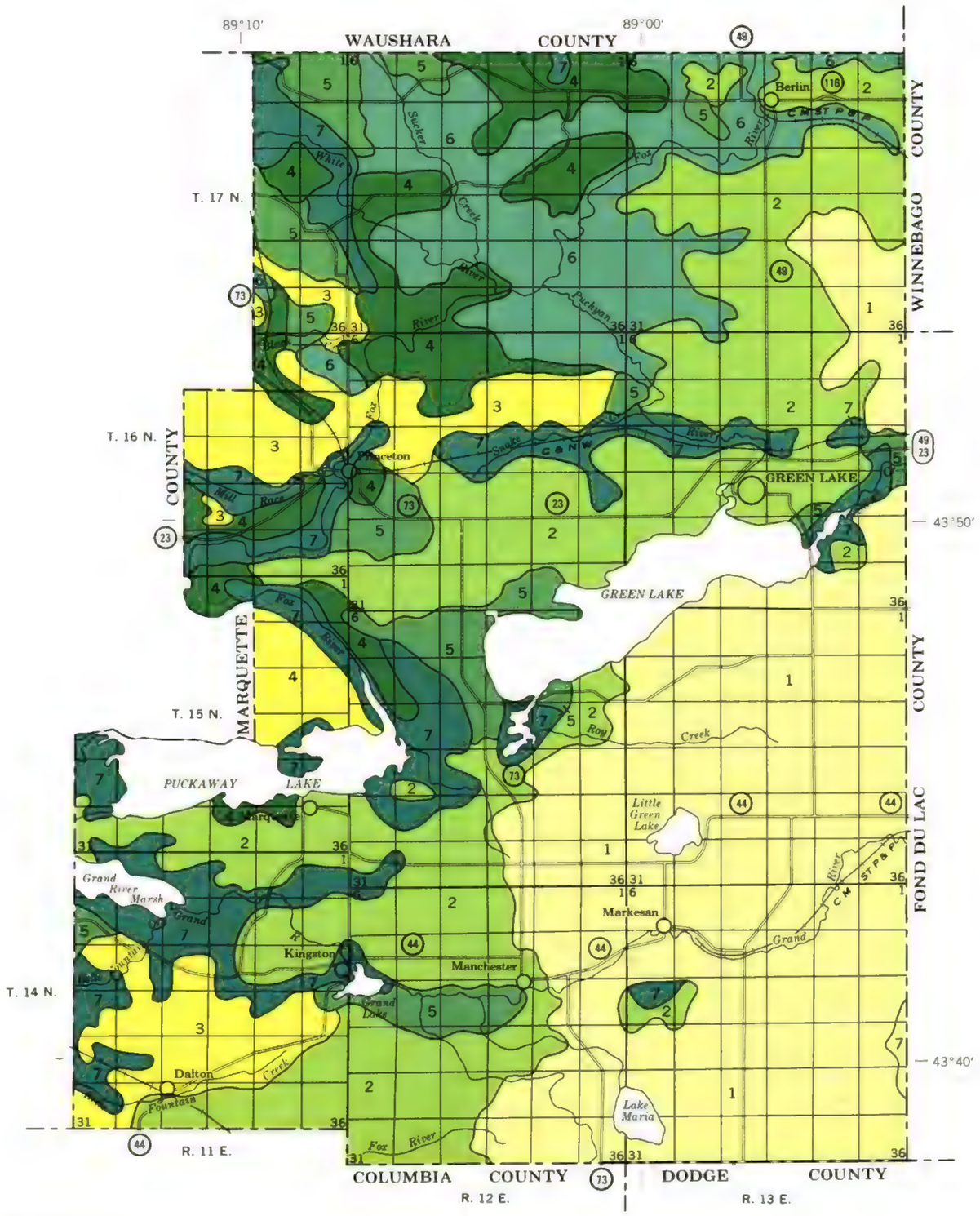


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
RESEARCH DIVISION
COLLEGE OF AGRICULTURAL AND LIFE SCIENCES
UNIVERSITY OF WISCONSIN

GENERAL SOIL MAP

GREEN LAKE COUNTY, WISCONSIN

Scale 1:190,080

1 0 1 2 3 4 Miles

N

SOIL ASSOCIATIONS

1 — Plano-Mendota-St. Charles association: Well drained and moderately well drained, nearly level to sloping soils that have a subsoil mainly of silt loam and silty clay loam underlain by calcareous, gravelly or very gravelly, sandy loam glacial till

2 — Kidder-Rotamer-Grellton association: Well drained and moderately well drained, nearly level to steep soils that have a subsoil mainly of loam, clay loam, and sandy clay loam underlain by calcareous, gravelly, sandy loam glacial till

3 — Lapeer-Mecan-Okee association: Well drained and somewhat excessively drained, gently sloping to steep soils that have a subsoil of sandy loam underlain by calcareous, gravelly sandy loam or gravelly loamy sand glacial till

4 — Oakville-Brems-Granby association: Well drained, moderately well drained, and poorly drained, nearly level to steep soils that have a subsoil of fine sand underlain by fine and medium sand

5 — Boyer-Oshtemo-Gotham association: Well drained and somewhat excessively drained, nearly level to steep soils that have a subsoil mainly of loamy fine sand, sandy loam, and loamy sand underlain by sand or stratified sand and gravel outwash

6 — Willette-Poy-Poygan association: Very poorly drained and poorly drained, nearly level organic soils and soils that have a subsoil of silty clay and clay underlain by sand or calcareous clay and silty clay

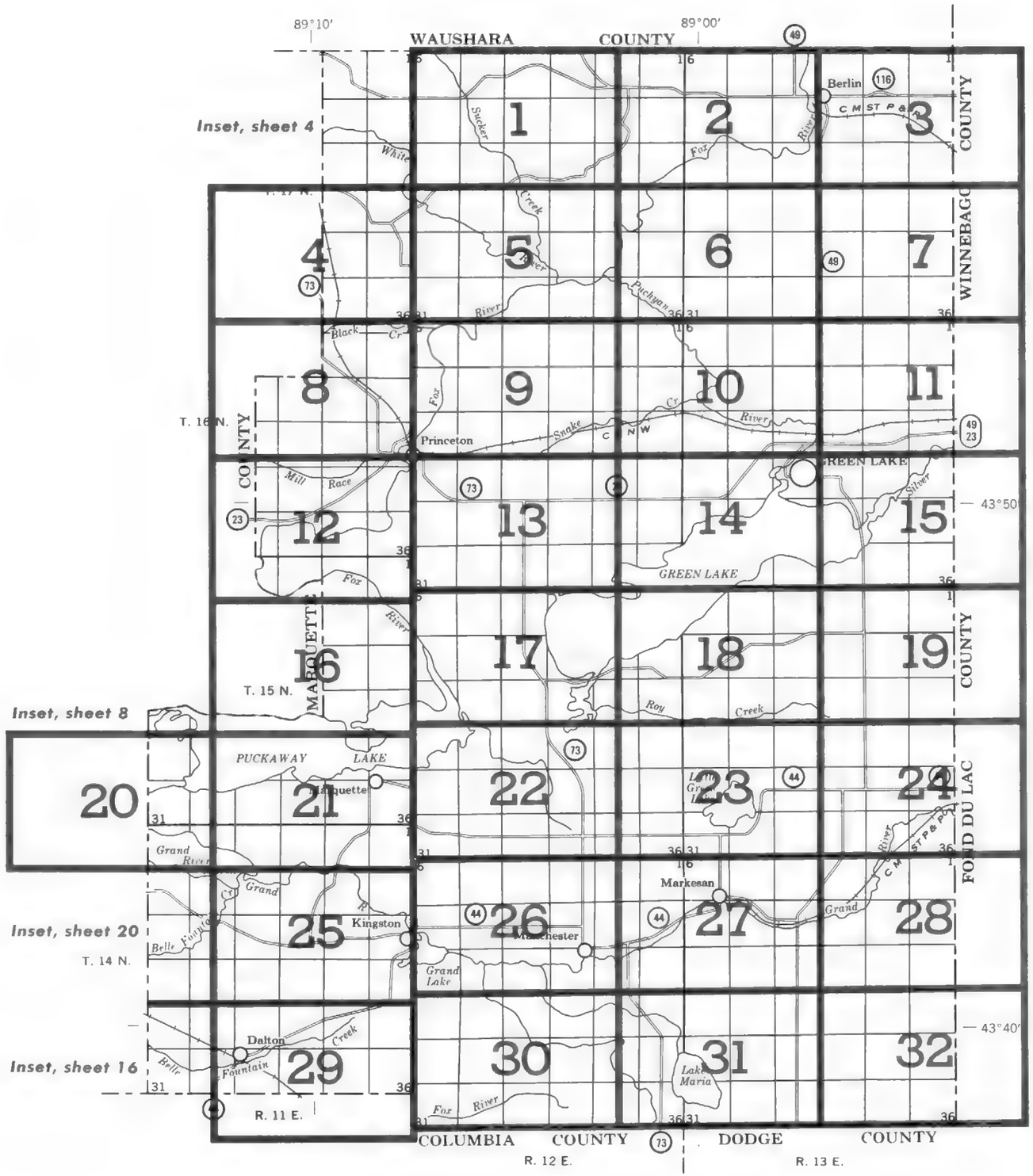
7 — Adrian-Houghton association: Very poorly drained, nearly level organic soils underlain by sandy, loamy, or clayey material or marl

Compiled 1976

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



N

INDEX TO MAP SHEETS

GREEN LAKE COUNTY, WISCONSIN

Scale 1:190,080

1 0 1 2 3 4 Miles

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

The first capital letter is the first letter of the soil name. A second capital letter A, B, C, D, or E shows the slope. Symbols without slope are mostly for level or nearly level soils. A final number 2 in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ad	Adrian muck
An	Alluvial land, wet
Bb	Barry loam
BpB	Boyer loamy fine sand, 1 to 6 percent slopes
BpC2	Boyer loamy fine sand, 6 to 12 percent slopes, eroded
BpD	Boyer loamy fine sand, 12 to 25 percent slopes
BrB	Brems loamy fine sand, 0 to 6 percent slopes
BsA	Briggsville silt loam, 0 to 2 percent slopes
BsB	Briggsville silt loam, 2 to 6 percent slopes
Co	Colwood silt loam
DdB	Dodge silt loam, 2 to 6 percent slopes
DdC2	Dodge silt loam, 6 to 12 percent slopes, eroded
Ed	Edwards muck
FoA	Friesland loam, 0 to 2 percent slopes
FoB	Friesland loam, 2 to 6 percent slopes
GaB	Gotham loamy fine sand, 1 to 6 percent slopes
GaC	Gotham loamy fine sand, 6 to 12 percent slopes
GbC	Gotham loamy fine sand, sandstone substratum, 6 to 12 percent slopes
GbD	Gotham loamy fine sand, sandstone substratum, 12 to 20 percent slopes
Gf	Granby loamy fine sand
GhA	Granby loamy fine sand, loamy subsoil variant, 0 to 3 percent slopes
GkA	Granby loamy fine sand, clayey subsoil variant, 0 to 3 percent slopes
GnA	Grellton fine sandy loam, 0 to 2 percent slopes
GnB	Grellton fine sandy loam, 2 to 6 percent slopes
GnC2	Grellton fine sandy loam, 6 to 12 percent slopes, eroded
GnD2	Grellton fine sandy loam, 12 to 20 percent slopes, eroded
GrA	Griswold silt loam, 0 to 2 percent slopes
GrB	Griswold silt loam, 2 to 6 percent slopes
GrC2	Griswold silt loam, 6 to 12 percent slopes, eroded
Ho	Houghton muck
JoA	Joy silt loam, 0 to 3 percent slopes
KbA	Kibbie loam, 0 to 3 percent slopes
KdA	Kidder fine sandy loam, 0 to 2 percent slopes
KdB	Kidder fine sandy loam, 2 to 6 percent slopes
KdC2	Kidder fine sandy loam, 6 to 12 percent slopes, eroded
KdD2	Kidder fine sandy loam, 12 to 20 percent slopes, eroded
KeA	Kidder loam, 0 to 2 percent slopes
KeB	Kidder loam, 2 to 6 percent slopes
KeC2	Kidder loam, 6 to 12 percent slopes, eroded
KeD2	Kidder loam, 12 to 20 percent slopes, eroded
KeE	Kidder loam, 20 to 30 percent slopes
KwA	Knowles silt loam, 0 to 2 percent slopes
KwB	Knowles silt loam, 2 to 6 percent slopes
KwC2	Knowles silt loam, 6 to 12 percent slopes, eroded
KwD2	Knowles silt loam, 12 to 20 percent slopes, eroded
LaB	Lapeer loamy fine sand, 2 to 6 percent slopes
LaC2	Lapeer loamy fine sand, 6 to 12 percent slopes, eroded
LaD2	Lapeer loamy fine sand, 12 to 25 percent slopes, eroded
Lb	Lapeer fine sandy loam, 0 to 2 percent slopes
LrC2	LeRoy silt loam, 6 to 12 percent slopes, eroded
LrD2	LeRoy silt loam, 12 to 20 percent slopes, eroded
LvB	Lomira silt loam, 2 to 6 percent slopes
LvC2	Lomira silt loam, 6 to 12 percent slopes, eroded
LvD2	Lomira silt loam, 12 to 20 percent slopes, eroded
MaA	Manawa silt loam, 0 to 3 percent slopes
McA	Marcellon loam, 0 to 3 percent slopes
MdB2	Markesan silt loam, 2 to 6 percent slopes, eroded
MdC2	Markesan silt loam, 6 to 12 percent slopes, eroded
MdD2	Markesan silt loam, 12 to 20 percent slopes, eroded
Mf	Marsh
Mh	Marshan silt loam
MnB	Mecan loamy fine sand, 2 to 6 percent slopes
MnC2	Mecan loamy fine sand, 6 to 12 percent slopes, eroded
MsA	Mendota silt loam, 0 to 2 percent slopes
MsB	Mendota silt loam, 2 to 6 percent slopes
MsC2	Mendota silt loam, 6 to 12 percent slopes, eroded
OaB	Oakville fine sand, 1 to 6 percent slopes
OaC	Oakville fine sand, 6 to 12 percent slopes
OaD	Oakville fine sand, 12 to 35 percent slopes
OkB	Okee loamy fine sand, 1 to 6 percent slopes
OkC	Okee loamy fine sand, 6 to 15 percent slopes
OmB	Oshtemo loamy fine sand, 1 to 6 percent slopes
OmC2	Oshtemo loamy fine sand, 6 to 12 percent slopes, eroded
Os	Ossian silt loam
Pa	Palms muck
PnA	Plano silt loam, 0 to 2 percent slopes
PnB	Plano silt loam, 2 to 6 percent slopes
Pr	Poy silty clay loam
Py	Poygan silty clay loam
RaB	Richford loamy sand, 1 to 6 percent slopes
RaC	Richford loamy sand, 6 to 15 percent slopes
ReB	Ripon silt loam, 1 to 6 percent slopes
RhB2	Ritchey silt loam, 2 to 6 percent slopes, eroded
RhC2	Ritchey silt loam, 6 to 12 percent slopes, eroded
RhD2	Ritchey silt loam, 12 to 20 percent slopes, eroded
RkE	Rock land and Ritchey soils, 6 to 45 percent slopes
Ro	Rock outcrop
RsD	Rodman gravelly sandy loam, 6 to 20 percent slopes
RsE	Rodman gravelly sandy loam, 20 to 35 percent slopes
RtB2	Rotamer sandy loam, 2 to 6 percent slopes, eroded
RtC2	Rotamer sandy loam, 6 to 12 percent slopes, eroded
RtD2	Rotamer sandy loam, 12 to 20 percent slopes, eroded
RtE	Rotamer sandy loam, 20 to 30 percent slopes
ScA	St. Charles silt loam, 0 to 2 percent slopes
ScB	St. Charles silt loam, 2 to 6 percent slopes
ScC2	St. Charles silt loam, 6 to 12 percent slopes, eroded
SnB	Sisson loam, 2 to 6 percent slopes
SnC2	Sisson loam, 6 to 12 percent slopes, eroded
SnD2	Sisson loam, 12 to 20 percent slopes, eroded
TuB	Tustin loamy fine sand, 1 to 6 percent slopes
UrB	Urne loamy fine sand, 2 to 6 percent slopes
UrC2	Urne loamy fine sand, 6 to 12 percent slopes, eroded
UrD2	Urne loamy fine sand, 12 to 30 percent slopes, eroded
We	Willette muck
ZtA	Zittau silty clay loam, 0 to 3 percent slopes

GREEN LAKE COUNTY, WISCONSIN

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)

- Located object (label)

- Tank (label)

- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)

  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Moderately deep silty overburden over organic materials, 3 acres or less

GREEN LAKE COUNTY, WISCONSIN — SHEET NUMBER 1

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GREEN LAKE COUNTY, WISCONSIN NO. 1

GREEN LAKE COUNTY, WISCONSIN — SHEET NUMBER 2

R. 12. E. R. 13 E.

WAUSHARA COUNTY

T. 17 N.

2 275 000 FEET

720 000 FEET

710 000 FEET

2 255 000 FEET

BERLIN

Barnes Creek

Fox River

Fox River

TOWN DRAIN

Pr (Joins Sheet 11)

Pa (Joins sheet 6)

(Joins sheet 3)

GkA

KdB

RtB2

N

1 Mile

5 000 Feet

Scale · 1 : 20000

GREEN LAKE COUNTY, WISCONSIN NO. 2

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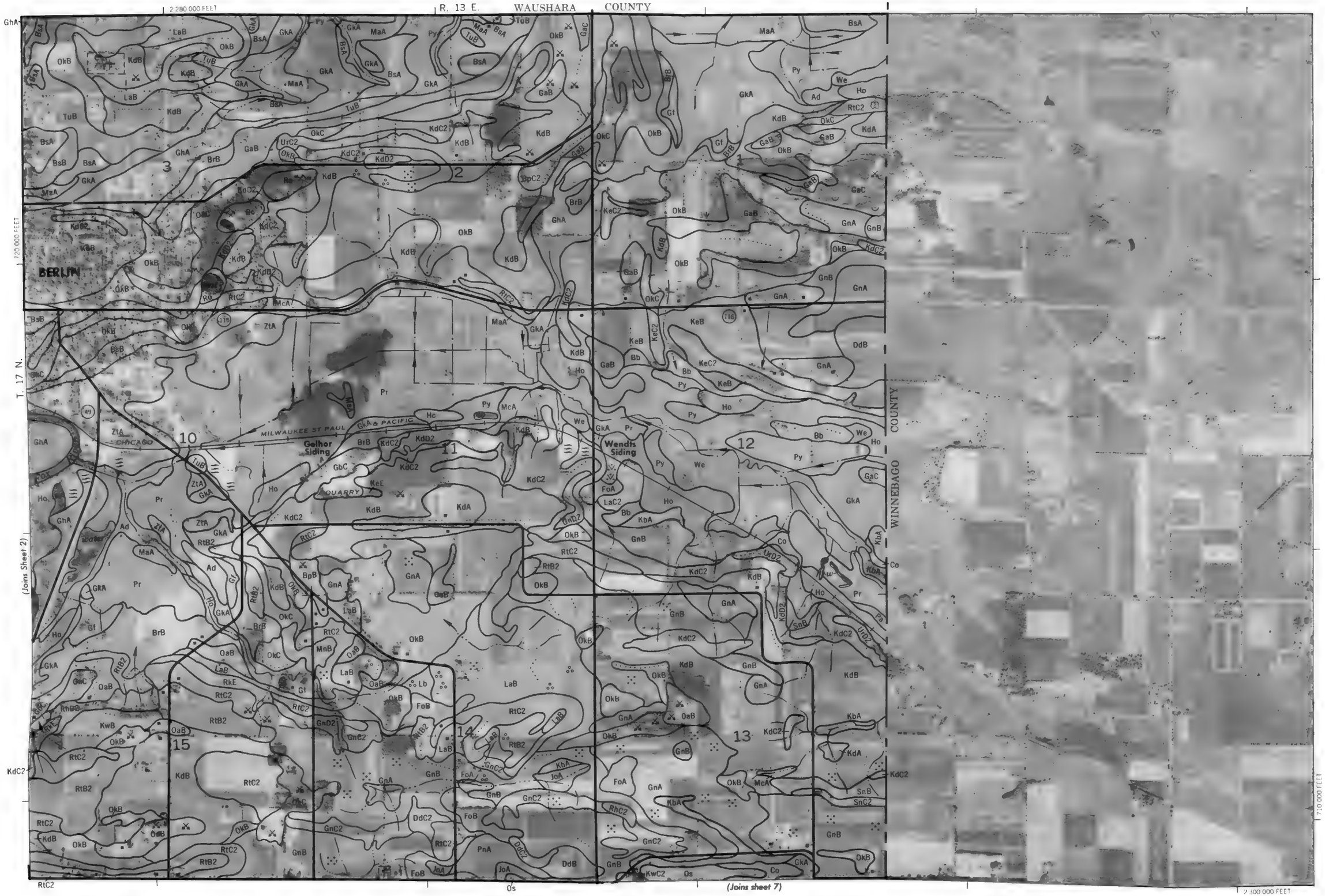
GREEN LAKE COUNTY, WISCONSIN — SHEET NUMBER 3



GREEN LAKE COUNTY, WISCONSIN NO. 3

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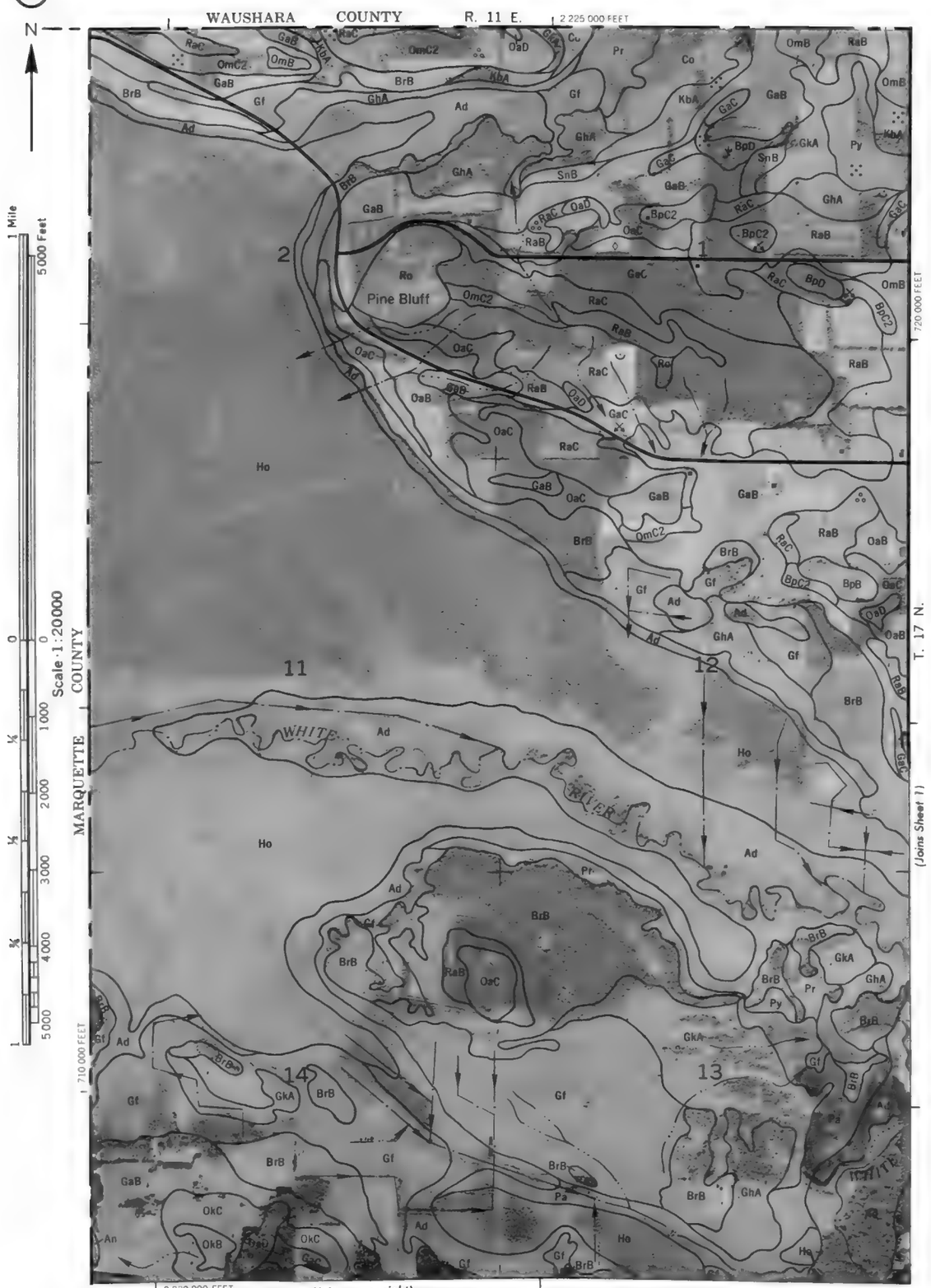

GREEN LAKE COUNTY, WISCONSIN NO. 4

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Coordinate grid lines and land division corners of record are approximately positioned

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Coordinate grid ticks and land division corners if shown, are approximately positioned.

GREEN LAKE COUNTY, WISCONSIN NO. 5

6

N

1 Mile
5000 Feet

Scale 1:20000

R. 12 E. | R. 13 E.

T. 17 N.

(Joins Sheet 2)

(Joins Sheet 5)

(Joins Sheet 7)

(Joins Sheet 10)

2 276 000 FEET

705 000 FEET

695 000 FEET

2 255 000 FEET

Fox River

Puchyan River

Puchyan

GREEN LAKE COUNTY, WISCONSIN NO. 6

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This map is compiled on 1974 aerial photographs by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Soil lines (corners if shown, are approximately positioned
(Coordinate grid ticks and land division corners if shown, are approximately positioned

GREEN LAKE COUNTY, WISCONSIN NO. 7

RtB2 280 000 FEET R. 13 E. (Joins Sheet 3)

T. 17 N.

705 000 FEET

(Joins Sheet 6)

WINNEBAGO COUNTY

695 000 FEET

(Joins Sheet 11)

2 300 000 FEET

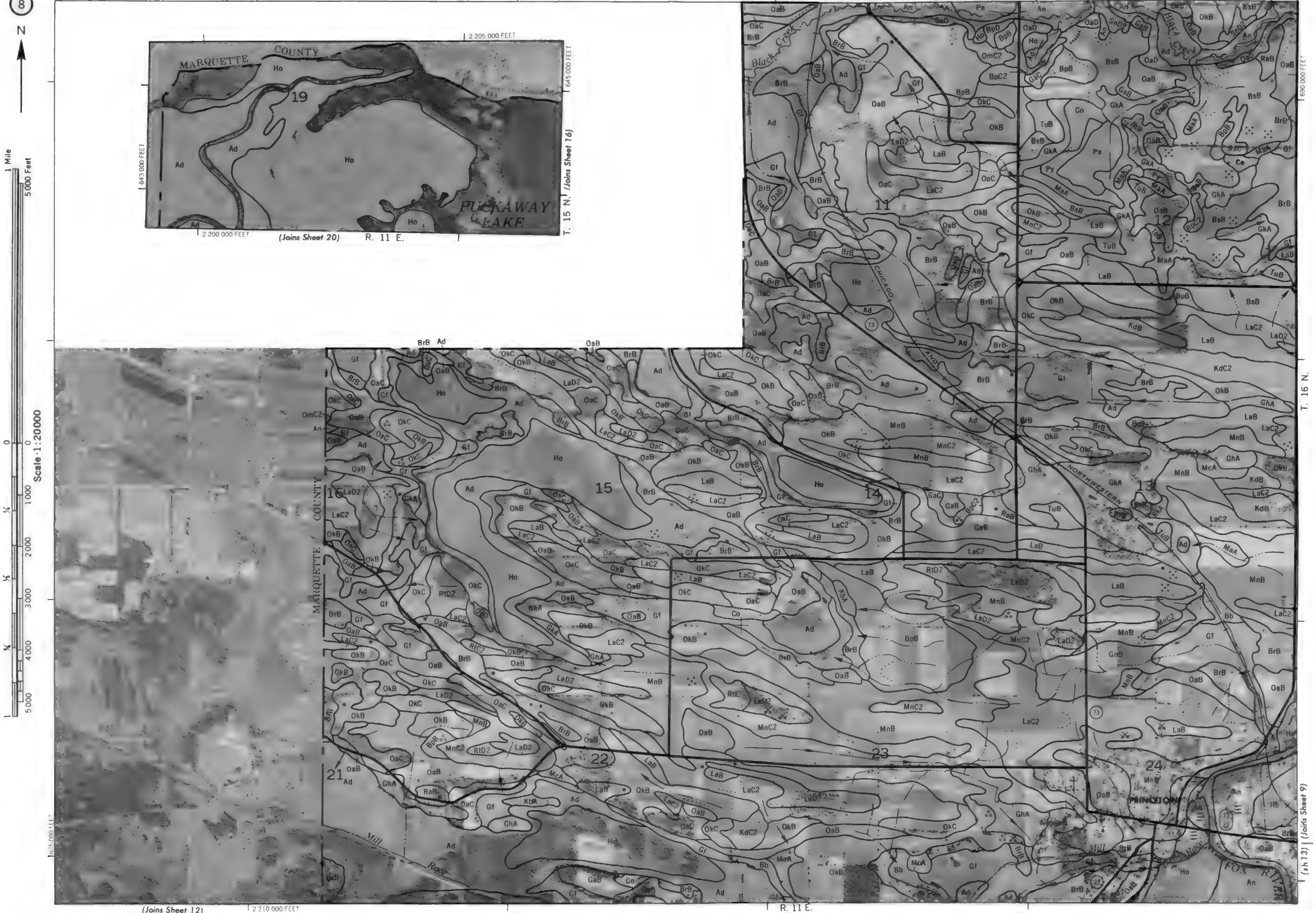
7

N

1 Mile 5 000 Feet

Scale · 1:20000

GREEN LAKE COUNTY, WISCONSIN — SHEET NUMBER 8



GREEN LAKE COUNTY, WISCONSIN NO. 8
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Boundaries shown are approximate
Coordinate grid ticks and land division corners if shown are approximate

GREEN LAKE COUNTY, WISCONSIN NO. 9

2 230 000 FEET

690 000 FEET

R. 12 E.

(Joins Sheet 5)

T. 16 N.

(Joins Sheet 8)

(Joins Sheet 10)

680 000 FEET

(Joins Sheet 13)

Mount Tom

Creek

Snake

CHICAGO AND NORTHWESTERN

PRINCETON

9

N

1 Mile

5000 Feet

Scale 1:20000

GREEN LAKE COUNTY, WISCONSIN — SHEET NUMBER 10

(10)

N

1 Mile

5000 Feet

Scale 1:20000

R. 12. E. | R. 13 E.

(Joins Sheet 6)

(Joins Sheet 9)

(Joins Sheet 14)

(Joins Sheet 11)

2 275 000 FEET

690 000 FEET

680 000 FEET

2 255 000 FEET

T. 16 N.

GREEN LAKE COUNTY, WISCONSIN NO. 10

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Coordinate grid ticks and land division corners as shown are approximately positioned

GREEN LAKE COUNTY, WISCONSIN NO. 11

2 280 000 FEET

R. 13 E. *(Joins Sheet 7)*

11

N

T. 16 N.

690 000 FEET

680 000 FEET

(Joins Sheet 10)

(Joins Sheet 15)

2 300 000 FEET

FOND DU LAC COUNTY

Green Lake Station

CHICAGO AND NORTHWESTERN

water

1 Mile 5000 Feet

Scale 1:20000

(12)

N

1 Mile

5000 Feet

Scale 1:20000

(Joins Sheet 8)

R. 11 E.

2 230 000 FEET

670 000 FEET

MARQUETTE COUNTY

Mill Race

Fox River

FOX RIVER

QUARRY

T. 16 N.

T. 15 N.

(Joins Sheet 13)

(sh 17)

2 210 000 FEET

(Joins Sheet 16)

GREEN LAKE COUNTY, WISCONSIN NO. 12

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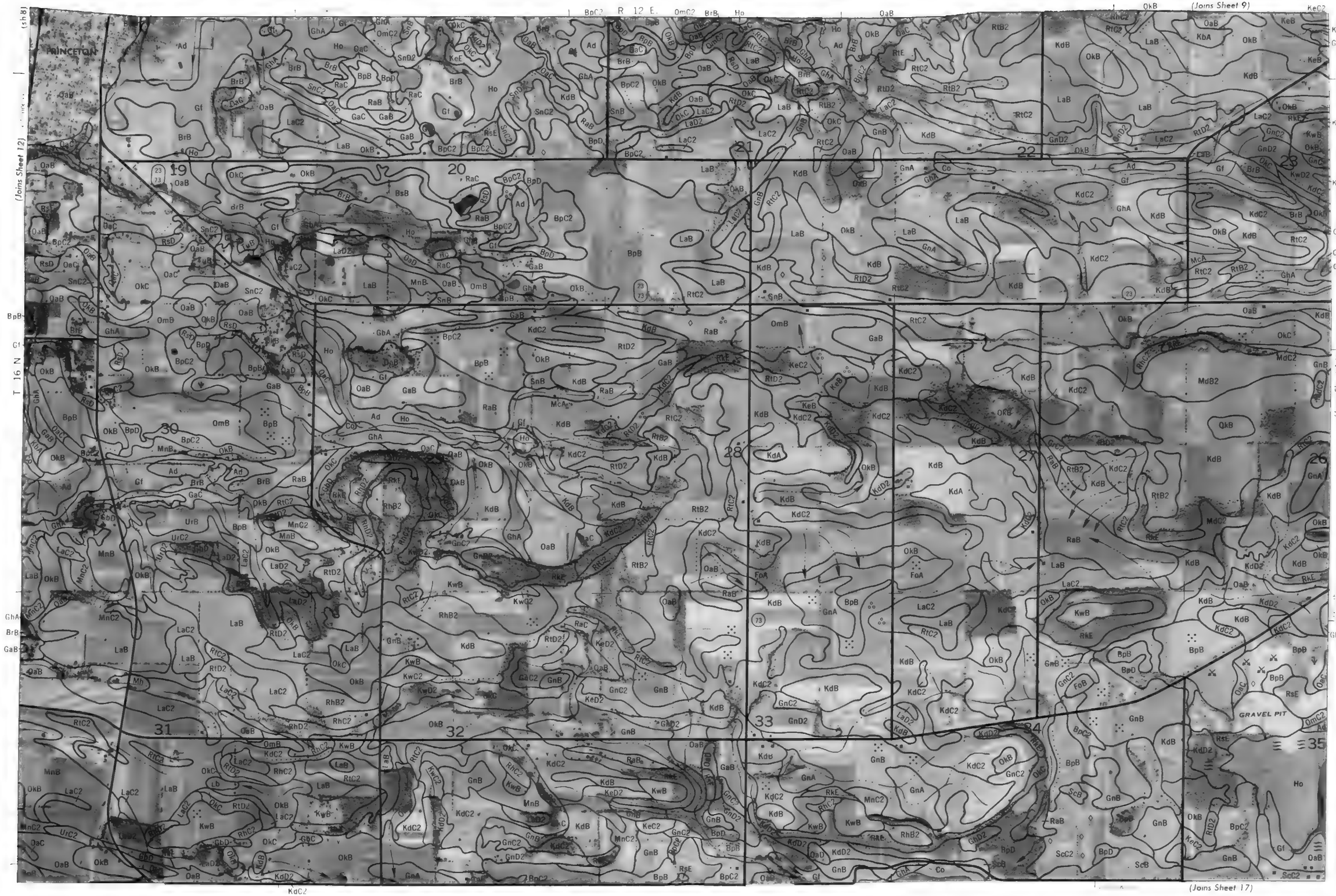
Information compiled on 1974 aerial photography by the Department of Agriculture, Conservation and Consumer Services
Soil survey field work was completed in 1963

GREEN LAKE COUNTY, WISCONSIN NO. 13



(14)

N

R. 12. E. | R. 13 E.

T. 16 N.

(Joins Sheet 10)

(Joins Sheet 13)

(Joins Sheet 15)

(Joins Sheet 18)

2 275 000 FEET

675 000 FEET

665 000 FEET

2 255 000 FEET

1 Mile

5000 Feet

Scale · 1 : 20000

1 0 1 000 2 000 3 000 4 000 5000

Green Lake

Dartford Bay

Pleasant Point

Malcolm Bay

GREEN LAKE

Pigeon Cove

Lone Tree Point

Norwegian Bay

Sandstone Bluff

Wood Bay

Tuleta Hills

Spring Grove

GREEN LAKE COUNTY, WISCONSIN NO. 14

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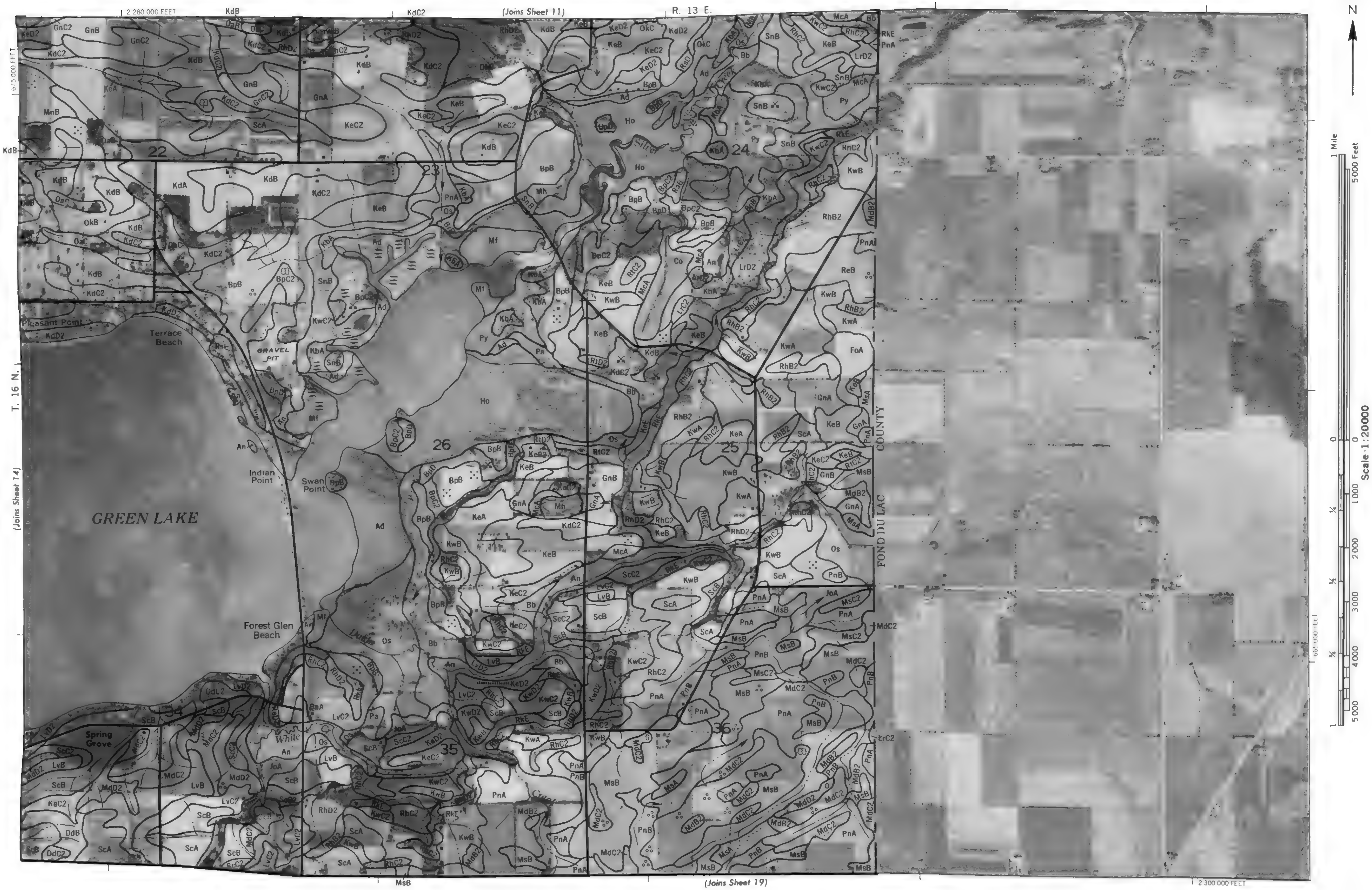

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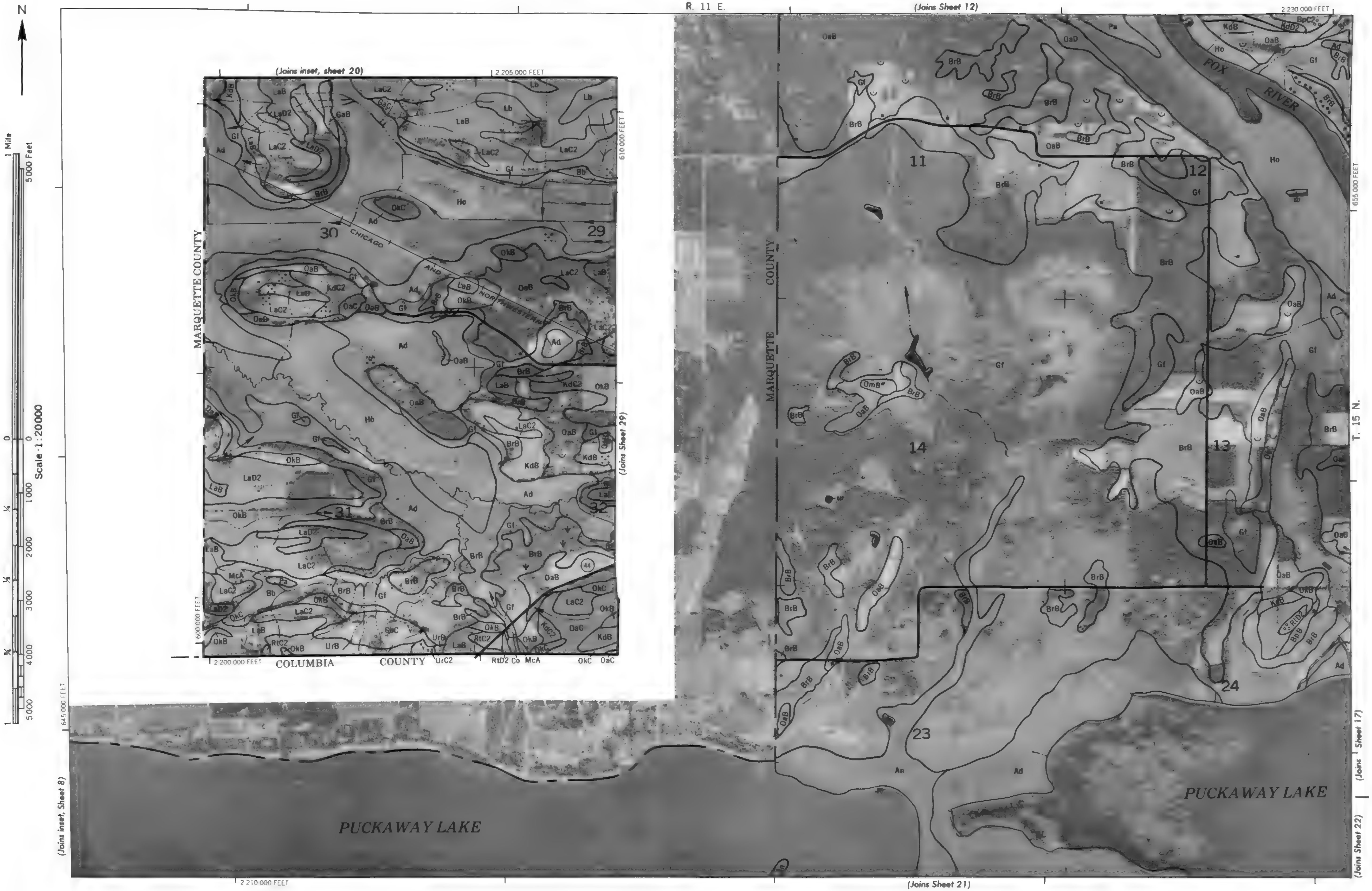

GREEN LAKE COUNTY, WISCONSIN NO. 16

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

GREEN LAKE COUNTY, WISCONSIN — NO. 17

17

N

R. 12 E

(Joins Sheet 13)

(Joins Sheet 16) | (Joins Sheet 12)

T. 15 N.

(Joins Sheet 18)

(Joins Sheet 22)

GREEN LAKE

PUCKAWAY LAKE

FOX RIVER

Blackbird Point

Green Lake Terrace

Spring Creek

Roy Creek

Beyers Cove

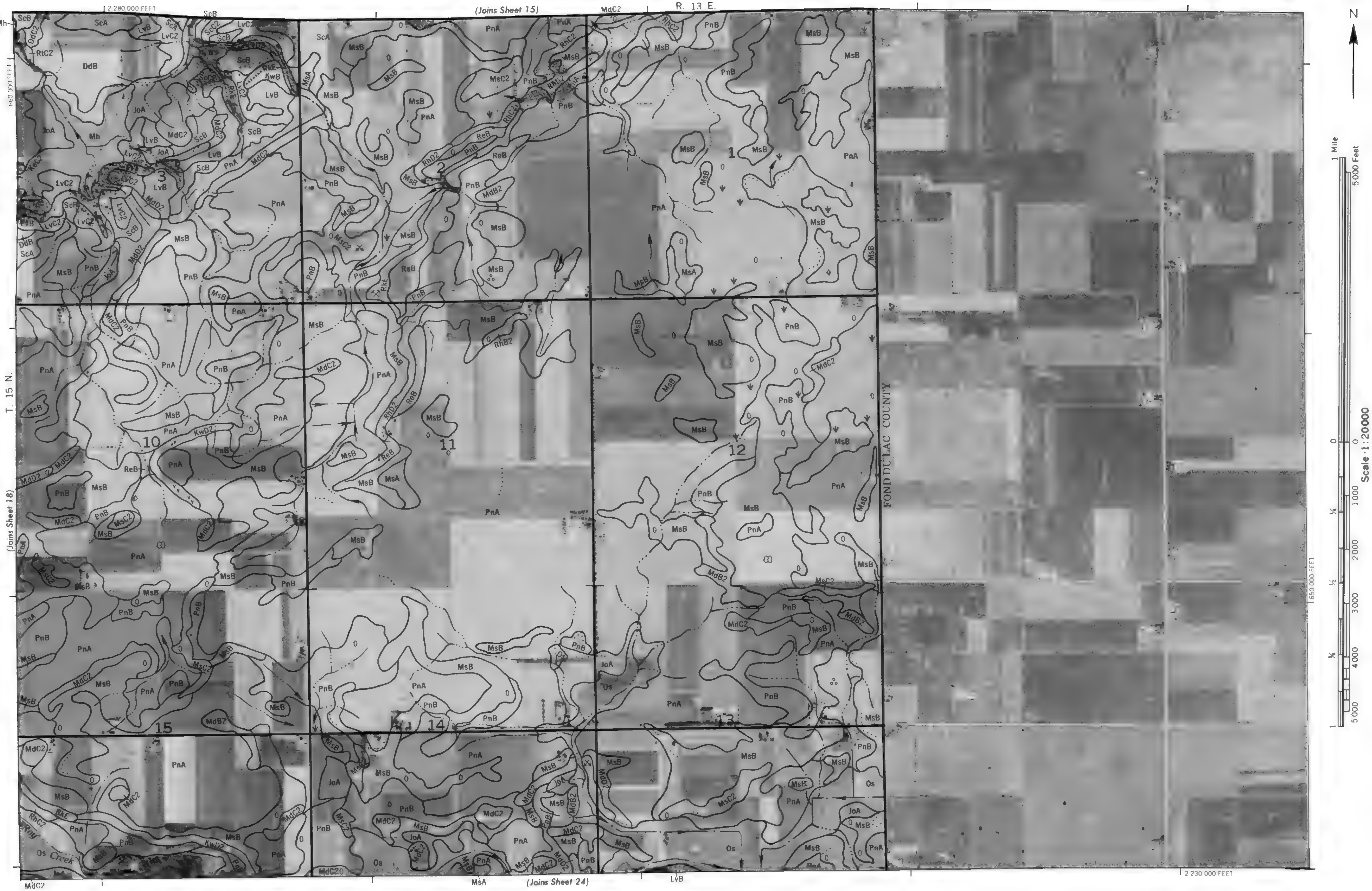
1 Mile

5000 Feet

Scale 1:20000

2,250,000 FEET


(Joins Sheet 14)
R. 12 E. | R. 13 E.
GREEN LAKE
Spring Lake
Big Twin Lake
Little Twin Lake
Spring Creek
Tuleta Hills
Center house
(Joins Sheet 17)
(Joins Sheet 19)
(Joins Sheet 23)
T. 15 N.
Scale 1:20000
1 Mile
5000 Feet
N
18
GREEN LAKE COUNTY, WISCONSIN NO. 18



GREEN LAKE COUNTY, WISCONSIN NO. 19

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20

N

1 Mile 5000 Feet

Scale 1:20000

(Joins lower right) R. 11 E. 2 205 000 FEET

625 000 FEET

T. 14 N.

615 000 FEET

2 200 000 FEET (Joins inset, Sheet 16)

Grand River

MARQUETTE COUNTY

Ad (Joins inset, Sheet 8) R. 11 E. 2 205 000 FEET

640 000 FEET

Haystack Point

PUCKAWAY LAKE

T. 14 N. | T. 15 N. (Joins Sheet 21)

630 000 FEET

2 200 000 FEET (Joins upper left)

(Joins Sheet 25)

GREEN LAKE COUNTY, WISCONSIN NO. 20

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This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid lines and land div s on corners ? shown are approximate y pos tioned

GREEN LAKE COUNTY, WISCONSIN NO. 21

R. 11 E.

(Joins Sheet 16)

PUCKAWAY LAKE

T. 14 N. | T. 15 N.

(Joins Sheet 20)

Grand River

Grand River

(Joins Sheet 25)

(Joins Sheet 22)

Marquette

21

N

1 Mile

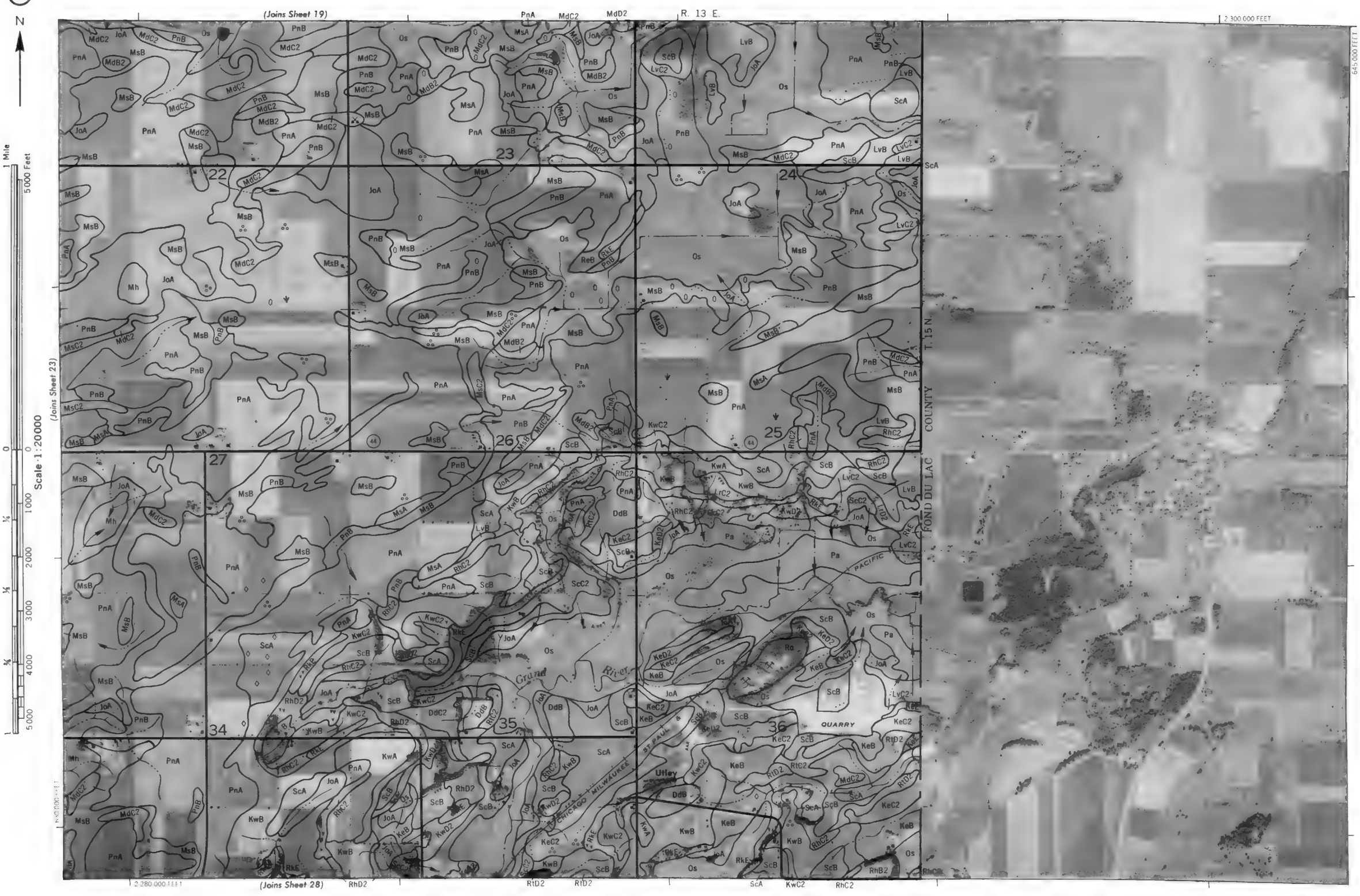
5000 Feet

Scale 1:20000

GREEN LAKE COUNTY, WISCONSIN NO. 22

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GREEN LAKE COUNTY, WISCONSIN NO. 23



1 Mile
5000 Feet
0
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000

GREEN LAKE COUNTY, WISCONSIN NO. 24

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

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Coordinate grid ticks and land division corners, if shown, are approximately positioned

GREEN LAKE COUNTY, WISCONSIN NO. 25

R. 11 E.

(Joins Sheet 21)

(Joins inset, Sheet 20)

(Joins Sheet 29)

(Joins Sheet 26) (sh 30)

T. 14 N.

Grand River

Spring Lake

Kingston

GRAVEL PIT

Grand Lake

Fountain

Belle

N

1 Mile

5000 Feet

Scale 1:20000

GREEN LAKE COUNTY, WISCONSIN NO. 26

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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GREEN LAKE COUNTY, WISCONSIN NO. 27

R. 12 E. R. 13 E.

T. 14 N.

(Joins Sheet 23)

(Joins Sheet 26)

(Joins Sheet 28)

(Joins Sheet 31)

MARKESAN

Grand River

Green River

CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC R.R.

N

1 Mile 5000 Feet

Scale 1:20000

N

1 Mile

5000 Feet

Scale 1:20000

(Joins Sheet 24)

R. 13 E.

2 300 000 FEET

625 000 FEET

T. 14 N.

COUNTY

FOND DU LAC

(Joins Sheet 27)

(Joins Sheet 32)

PACIFIC

ST PAUL

MILWAUKEE

CHICAGO

Grand River

10 11 12 15 14 13 2 3 1

GREEN LAKE COUNTY, WISCONSIN NO. 28

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N

R. 12. E.

T. 14 N.

2 250 000 FEET

2 235 000 FEET

1 610 000 FEET

1 600 000 FEET

(Joins Sheet 26)

(Joins Sheet 29)

(Joins Sheet 31)

COLUMBIA COUNTY

Scale 1:20000

1 Mile 5000 Feet

0 1000 2000 3000 4000 5000

GREEN LAKE COUNTY, WISCONSIN NO. 30

This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Soil lines shown are approximately positioned
Coordinate grid ticks and land division corners, if shown, are approximately positioned

GREEN LAKE COUNTY, WISCONSIN NO. 31

T. 14 N.

R. 12. E. | R. 13 E.

(Joins Sheet 27)

(Joins Sheet 30)

(Joins Sheet 32)

LAKE MARIA

COLUMBIA COUNTY | DODGE COUNTY

2 255 000 FEET

2 275 000 FEET

610 000 FEET

600 000 FEET

N

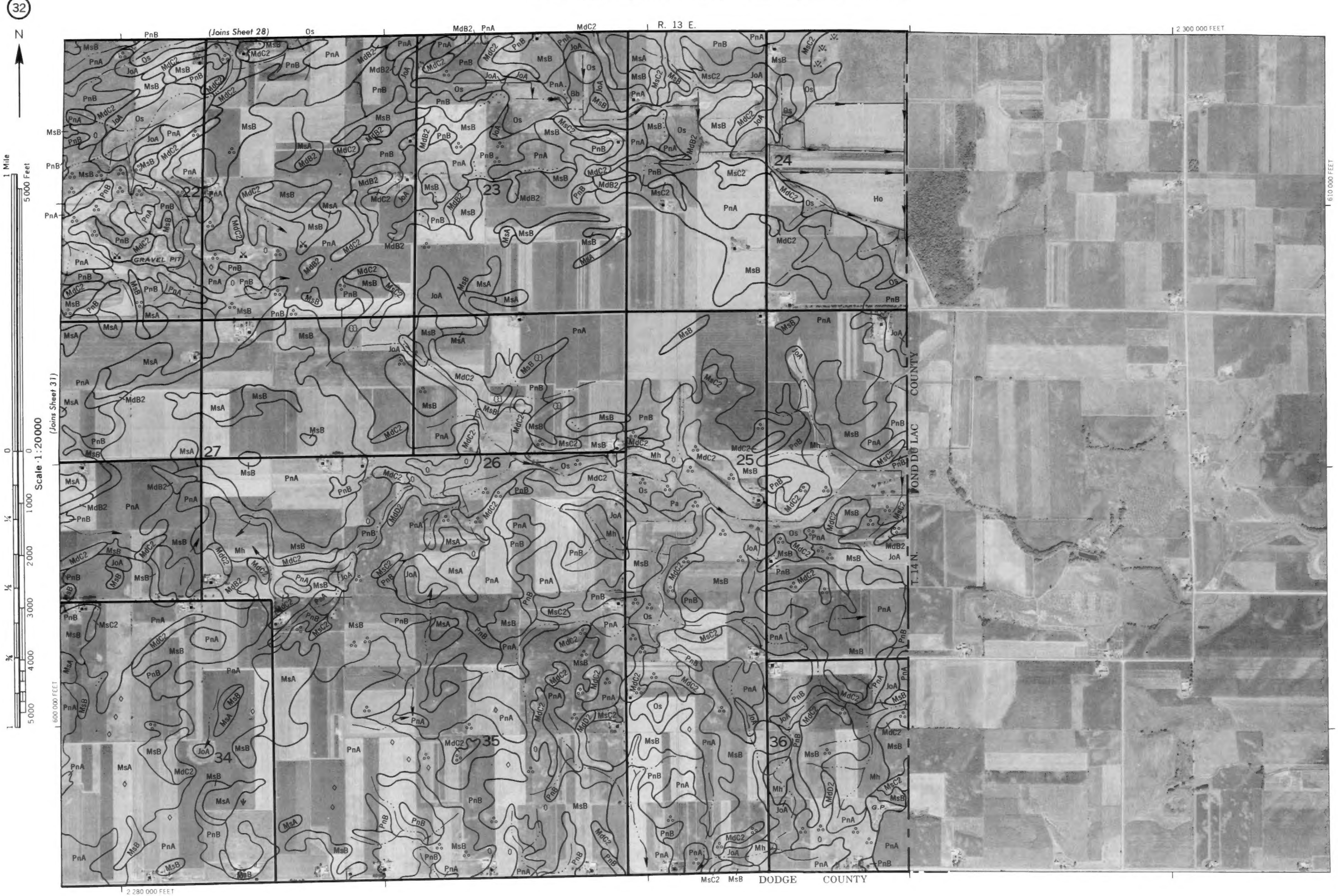
1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



GREEN LAKE COUNTY, WISCONSIN NO. 32

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.